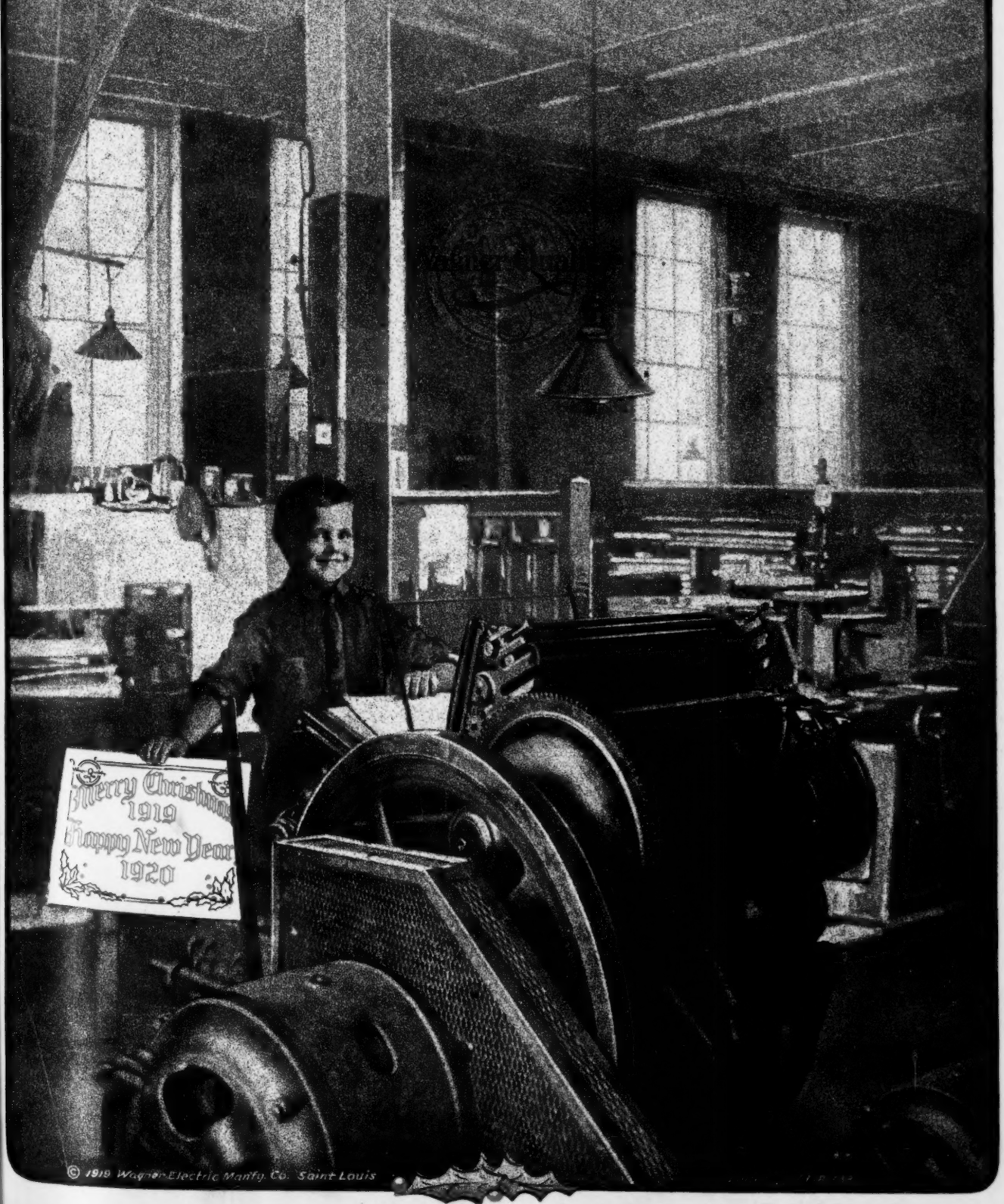
PUBLISHED DECEMBER 20, 1919, WITH CURRENT NEWS

Electrical World

McGraw-Hill Company, Inc. New York, December 13, 1919 Fifteen Cents a Copy



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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 74 New York, Saturday, December 13, 1919 *Number* 20

Self-Interest in Electrical Development

ON ANOTHER page of this issue of the ELECTRICAL WORLD A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation and president of the Pacific Coast Section, N. E. L. A., tells with earnest emphasis a story of self-interest that is catching the attention of large audiences before which it is being unfolded in the Far West.

When, for instance, the public is told that $250,000,000 is to be invested in California during the next decade if reasonable encouragement is given to power development, little interest is created except an intangible pride in state growth. But when it is shown that to the transformer man reasonable encouragement of hydroelectric power investments means nearly $2,000,000 in line transformers and devices alone, that to the lumberman it means nearly $4,000,000 in new business, and that to plasterer, carpenter, plumber and, indeed, to every class of skilled and unskilled worker, it has a definite dollar-and-cent value, then an interest is aroused that should sweep opposition before it. The electrical industry, so potent when the freedom of the world was at stake, should arouse itself to its birthright of leadership in the vast problems of readjustment. The self-interest story will bring results. Let us have a slogan so broad as to embrace every class of citizenry: "Forward, America, with the electrical industry leading!"

The will to work forms a credit collateral of high rating to business statesmen with vision. Combined with basically sound financial position, good natural resources and capacity for expansion, it may be utilized to strengthen international trade relationships and ease the world of some of its terrific burdens.

Steel-Mill Motor Drives

BUILDERS of steel-mill machinery still continue to consider the electric drive as something incidental to the machinery itself and leave it to the electrical engineer in the plant to struggle with gear reduction and speeds and to find a suitable place for the motors. In new orders steel mills should insist that the electric motors in rolling mills, in charging machines, on cranes, etc., be considered an integral part of the machines and that the whole design should be adapted as much as possible to the best performance characteristics of the electric drive. The customer should merely express his preference for the make of the electric motor. There seems to be an insistent demand on the part of the electrical engineers connected with steel mills that motor manufacturers should standardize the drilling dimensions and the shafts of motors, so that they may be interchangeable.

Inter-Engineering Relationships

CONSIDERABLE thought and study are being devoted to the proper method of obtaining combined effort from all the engineers in a community with the object of presenting a united front to the public on questions of general engineering concern. Not only has the American Society of Mechanical Engineers devoted hours of constructive discussion to this matter at its recent annual meeting, but engineers and engineering bodies generally throughout the nation are endeavoring to discover the best way in which harmonious and co-ordinated activity may be attained.

Once again the electrical engineer and the electrical industry bid fair to furnish a model to their fellow electricians. Fundamentally the result sought is to perfect a means by which engineers individually can express in a collective manner the thought of a great profession which in recent years has meant so much to material progress and to the welfare of free peoples the world over. Hence, in order that individual expression may the best be fostered, the mechanism adopted for such needs is that which begins first with the small group of the neighborhood, then the city, next the state or group of states, and finally the national organization.

It has been well demonstrated in the electrical industry that such organization is successful only in so far as personal contact is maintained with the group interested and with the public at large. This accounts for the marked success of such bodies as the Pacific Coast Section, N. E. L. A., the California Electrical Co-operative Campaign, and the joint councils of engineers now existing in Cleveland, San Francisco and other engineering centers of the nation.

In view of these facts it would seem that any national organization of an engineering nature organized to promote engineering activities in public affairs will prove successful only in so far as activity is limited first to the encouragement of local activity, next to the state or group of states, and only in exceptional instances to national activity. Any organization of this nature has fundamentally the crying need of vision to draw engineers into public activities. In local districts of the nation ample problems exist to tax the best expression and the best constructive imagination of our engineering talent, and when functioning from the bottom up, as it were, such organizations will prove of tremendous benefit, but not otherwise.

In the long run it is possible to take out of the great reservoir of production no more than is put into it. Limitation of output in the face of world-wide demands for production is certain to fail as a means of bettering either conditions or rewards.

The Eternal Labor Problem

EVERY employer of other hands than his own faces to-day a situation the gravity of which can scarcely be overestimated. The war necessarily and of itself removed three or four million able-bodied workers from their customary employment and deflected the efforts of at least twice as many more into unwonted paths in support of the great organization on the fighting line. Now, with hostilities ended by an armistice more than a year old, the difficulties of obtaining sufficient labor in the industries is greater rather than less than it was when America's fighting force was at the front. The situation and what it means was admirably discussed by William C. L. Eglin in our columns last week, especially with reference to the central station and allied industries. The cause of the present troubles is not a single one but a complicated aggregation of conditions not easy to analyze or to remedy.

To begin with, we are in the midst of a period of wild inflation, inflation just as genuine and perhaps not less harmful than if we had met the financial demands of the war by the familiar and widely followed method of starting the printing presses. Consequently the costs of everything, including labor, have been soaring, aided in no small degree by the nature of the contracts under which emergency work was undertaken, contracts lifting the lid off the price of labor and material and encouraging the raising of prices beyond the wildest dreams of the profiteer of yesterday, whether contractor or laborer. Add to this a mass of restrictive legislation and the too often insolent demands of the less wisely managed unions and we have all the explosive material for a tremendous upheaval of society. Mr. Eglin holds strongly that limitation of the hours of labor and a fixed rate of wages irrespective of working ability are two matters which have much to do with the present situation, uniting to block production and encourage mediocrity. Nobody has yet discovered what the rightful average length of the working day should be for the maximum benefit of mankind. The tendency, which can hardly now be averted, is to make a basic day of eight hours in most occupations, working in three shifts for continuous operation and on an overtime basis if the day extends beyond eight hours. Reductions below this point seem not now to be justified in the present state of industrial efficiency, and could only be justified were methods devised to maintain the world's necessary output in fewer hours. Mr. Eglin believes that the solution of the wages question ought to be a basic minimum wage plus some form of profit sharing determined with respect to the ability of individuals to perform their work.

This plan has been often tried and generally found wanting owing to the fierce opposition of most of the labor unions to any such program. As a rule the unions insist on collective bargaining, which is certainly a just principle, but they commonly graft upon it the closed shop and a minimum wage appropriate not to the poorest or the average but to the best grade of labor. The trades union is in itself a good thing and ought to lead to stable and satisfactory relations between employer and employed instead of the reverse. The one place where the union fails most diastrously is in its too frequent disregard of the obligation of contracts. Until a contract is legally binding on both sides it is not a contract but a somewhat unstable gentlemen's agreement like those entered into in bygone years by railroad presidents to be covertly broken as soon as the several adherents had reached their offices. We all know of unions under leadership wise and honorable enough to hold the contracting parties squarely in line, and in such instances labor troubles are few and far between. We do not believe that legislation can do much to improve the situation until it provides, if collective bargaining be undertaken, for the legal responsibility of both parties.

The second big question which lies back of the situation is that involved in the unequal abilities of men to perform the same task. In fact, it is not going too far to say that this is the critical point in the whole situation. One cannot under any democratic form of government follow to its logical conclusion the theory of some of the efficiency experts that all poor and indifferent workmen should be thrown out of their jobs, for if 25 per cent of the workmen in all occupations are discharged, then just 25 per cent of working humanity must starve or be supported by the other 75 per cent. In its larger aspect the proposition is unthinkable, and unless, as Mr. Eglin suggests, some form of profit sharing or graded payment allows the mediocre workman to earn an honest livelihood to the best of his mediocre abilities, then trouble is certainly brewing for society. The organization of personnel departments by large employers is surely a step in the right direction, for it avoids in no inconsiderable measure the attempts to fit square pegs into round holes that is the cause of much internal friction in loosely managed organizations.

Technical instruction and research must go forward hand in hand if American industry is to hold its place in competition with that of other countries in this changeful era. Alumni of our engineering schools cannot be expected to bear the whole burden of raising the endowments so vitally necessary to retain the services of the highest grade of instructors and to meet the increased costs of laboratory and classroom activities. What better investment can our industries make in looking toward future expansion and prosperity than a liberal contribution to the needs of these institutions, which have proved their worth to the country in both war and peace?

Loading the Efficient Stations

AS EXPERIENCE with interconnected central stations and transmission systems increases it becomes more apparent that the burdens of electrical supply tend to gravitate toward the more economical generating plants. After due allowances are made for losses in transmission and transformation to and at "key points" in the network, it is found in many instances that certain stations come to be leaned upon more and more in the operation of systems. Although in some cases energy is interchanged between plants on a fairly even basis, depending upon conditions of local load, water supply and fuel cost, this is not the way an interconnection invariably works out. The larger and more efficient plants tend to take on more and more load, whereas the normal function of tie lines is supposed by many people to be chiefly to effect a free interchange of energy.

This tendency toward the concentration of loads upon the more efficient stations is a mere commonplace to the engineer, but politically it is sometimes a source of no little embarrassment. Local pride in the old-time "electric light station" is sometimes seized upon as a pretext for agitation against interconnection with an outside system which can

deliver energy at the adjacent substation considerably cheaper than the longer established installation. Local politicians in such cases are tempted to "play up" the size and delivery prices of the outside system as evidences of its predatory character, as well as the shutting down of units in the local plant except when these may be required for stop-gap operation. Ridiculous as this may seem to an engineer or central-station operator with a broad knowledge of the benefits of skillfully operated interconnected systems, it is a very real obstacle to the tying together now and then of communities displaying more or less commercial or social rivalry, and it must be overcome with tact and good sense on the part of the utility executives concerned.

All up for constructive water-power legislation at the coming session of Congress in order that immediate progress shall be made toward the reclamation of resources hitherto squandered and neglected! The benefits of interconnection do not reach the newspaper headlines; but the savings in fuel and water, the better use of labor and the efficient capitalization associated with sound developments in this field form a leaven in the lump of economic confusion that should enlist the support of every public-spirted inhabitant of this country.

Concerning Electric Steel

SOME very interesting data have recently been published by the Electric Furnace Association concerning the use of the electric furnace in steel manufacture. As our readers know, there is a steadily increasing amount of electric steel manufactured, but few realize the rapid growth of this particular art. Ten years ago the production of electric steel was just beginning, and the total product was less than 0.1 per cent of the total steel produced. In 1918 the output of the electric steel furnaces ran to more than 800,000 tons, still a small proportion of the total, about 1.75 per cent, but providing no inconsiderable part—about 20 per cent—of the special alloy steels now coming into steadily increasing use. The reason for the increase is very clear, for the electric furnace gives a more perfect control of conditions than any other and consequently turns out a more reliably uniform product.

There are other advantages of electric steel which bear directly on its casting properties, for it can be successfully poured at a very high temperature and is therefore particularly well fitted to produce thin and complicated catsings with a small percentage of rejections, so that the introduction of the electric process has made it possible to use steel castings in constructions previously thought unsuitable for steel. One of the most striking results of the new process is the effect that is produced on the output of crucible steel. Ten years ago there was manufactured almost eight times as much crucible steel as electric steel. In 1918 the proportions were reversed and the ratio was more than four to one in favor of the electric product. Such a change is particularly significant with respect to the change in practice where special high-grade steels are required. At the present time there are nearly or quite 300 electric steel furnaces in use in this country, and the number is steadily increasing. It is altogether apparent that not only has electric steel come to stay but that it bids fair to lead to the very material improvement of steel, both in average quality and in variety, since the special alloy steels seem to present an especially useful field for the new metallurgy.

Testing Insulators

AS WORKING voltages have increased the difficulty of properly testing insulators has increased also. There are two good reasons for this. In the first place, a high factor of safety was easy with low voltages but is much harder with those now in use. In the second place, the production of suitable porcelain for high-voltage insulators in the necessary sizes is a task of far greater difficulty than the making of units for 10,000 volts to 20,000 volts. A brief paper by E. J. Kallevang gives some extremely suggestive hints as to the frequent causes of failure and suitable methods of testing. One of the most interesting suggestions which he makes is the probable deterioration of insulators which have never been subjected to strains upon the line. The particular case he cites deals with disk-type insulators which were quite unused although they had been in storage for some little time. The number of failures was very high compared with what would ordinarily be expected for material of this quality, and it became apparent that something was happening which had nothing to do with the voltage strains encountered in service.

That this something was mechanical there is little doubt, and the cause should be sought in the development of mechanical strains with time, perhaps in the porcelain and certainly in the cement used to unite the porcelain parts. Almost any material which has been subjected initially to a very high temperature is likely to develop strains with the mere passage of time. Such strains are known to result in changes in the lengths of even carefully prepared standards and in glass disks which, while apparently well annealed, eventually crack on very small provocation. It is possible that something of the same kind takes place in insulator porcelain, but the thing most under suspicion is the cement, which has a very different temperature coefficient from the porcelain which it joins and, further, a moisture coefficient of unknown character. Mr. Kallevang points out that in recent insulator designs there is a tendency toward the use of less cement, the building up of the porcelain in fewer and stronger parts, and particularly more elasticity in the cement. As to testing, nothing can quite give results comparable with actual use, for the probable effect of time is one which no test yet devised will show. The ordinary high-potential test is undoubtedly useful, especially for determining puncture and flash-over voltage. It does not, however, duplicate the unusual conditions on the line which come from grounds, resonance and lightning. The other current method of testing with a megger is simply a resistance measurement, perfectly good for detecting faults as between cap and pin or for picking out especially bad specimens. It works less well on insulators having large service or under conditions where surface leakage and not the resistance of the insulating material itself is the permanent feature of the situation. In addition to the tests described by Mr. Kallevang, a method and results described by T. F. Johnson (ELECTRICAL WORLD, Sept. 13, pages 568-572) are of particular interest.

Public virtues are but private ones writ large. The old-fashioned exhortation to constant diligence in attending to daily tasks, whether in factory, field, laboratory, classroom or counting house, has attained international significance in relation to the solution of reconstruction problems.

Electrical Energy Supply for Nitrate Plant

Electrical Machines Are Arranged to Facilitate Straight Copper Runs—A Storage Battery Will Carry Vital Loads in Case of Complete Generator Shut-down—The Plant Is a Model of Simplicity and Cleanliness

BY C. D. GRAY AND E. HAGENLOCHER
The J. G. White Engineering Corporation

IN A PREVIOUS article by Edward R. Welles and C. T. Mitchell (Electrical World, April 5, 1919) the general features of the power system supplying the United States Nitrate Plant No. 1 were given. Supplementing that description it is the present purpose to discuss the electrical features of this plant. It is particularly essential in the design of such a plant that the design be as simple as possible to aid in the commercial success of the undertaking. Provision should also be made to secure an unfailing source of electrical energy in emergency.

The main units consist of three turbo-alternators which generate 190-volt, six-phase, 60-cycle energy and feed into three rotaries which can convert the entire output of the generator into 250 volts direct current. The first unit consists of a 125-kva. alternator and a 1150-kva. rotary, the other two being larger—the alternators 1875 kva. and the rotaries 1700 kva. The original plans did not call for any alternating-current load except a small amount which had to be furnished through a storage battery and motor-generator sets. As the plans were developed, however, an acid plant, pumping station and permanent community were added which required alternating current on account of their distance from the power house. A bank of three 200-kva. transformers was added to the equipment to step up 190 volts, six-phase, to 2300 volts, three-phase. Later another bank of the same size was added, making a total of 1200 kva. alternating-current capacity. These transformers were fed from the transfer bus located between the rotaries and the generators.

Referring to the wiring diagram, it will be seen that each of the generators is connected to its corresponding rotary through two six-pole carbon circuit breakers and to a transfer bus through an additional six-pole breaker This arrangement gives great flexibility, which is of particular advantage in cutting machines out in case of trouble without dropping the load. Any generator can be connected directly to its rotary and to the direct-current bus, which is the normal arrangement. Moreover, any generator can be connected with any other rotary to feed the direct-current bus. In addition, the alternating-current load is supplied from the transfer bus, which in turn can be connected to any generator working alone or to several generators which may at the same time be feeding the direct-current bus through a rotary or rotaries. In other words, the load can be so divided between the generators and the rotaries as to make the units operate at their highest efficiency and also have the opportunity of keeping continuous power on the direct-current bus in case of breakdown of any of the machines. As an example, it may be mentioned that this plant had to be run before the protective apparatus such as circuit breakers and relays had arrived, while continuous power was kept on the direct-current bus in order not to interrupt the operations in the process building.

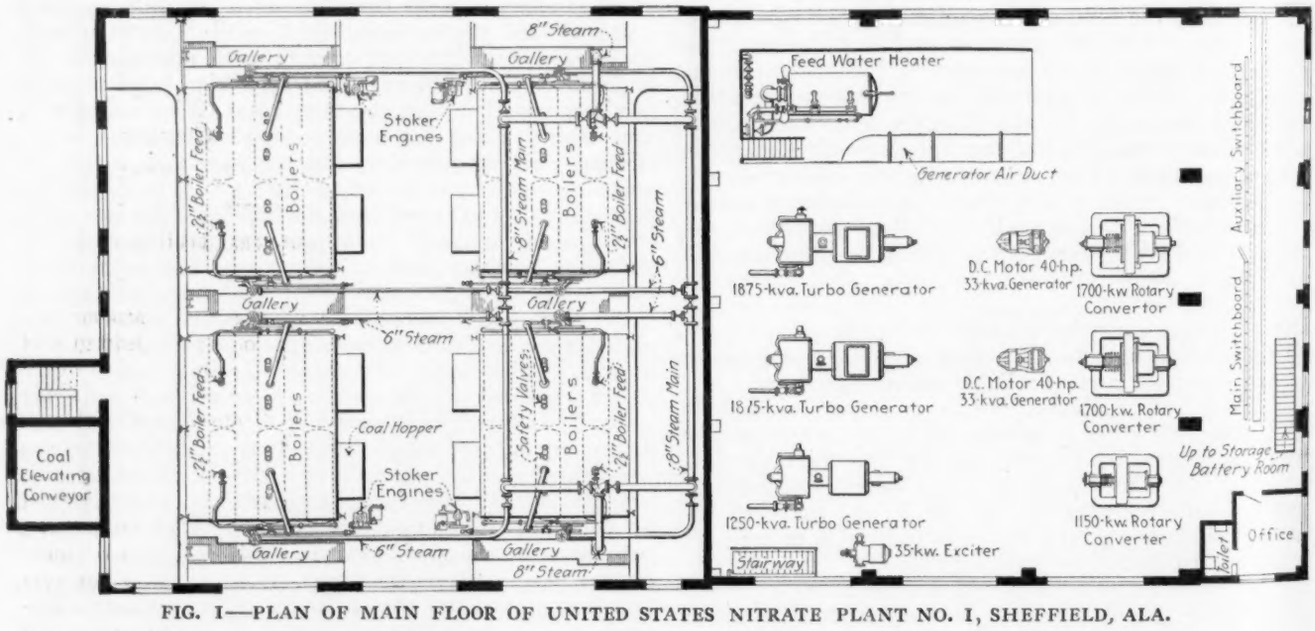


FIG. 1—PLAN OF MAIN FLOOR OF UNITED STATES NITRATE PLANT NO. 1, SHEFFIELD, ALA.

Aim Is for Simplicity in Construction

It will be noted from Fig. 1 that the general arrangement of the main electrical apparatus is such that the main cables and busbars are brought to their respective

switchboards in a direct line so as entirely to eliminate any excess copper.

The main connections between the turbo-generator and the rotaries were made of copper bars instead of cable inasmuch as this was the most economical and, in addition, made an arrangement which cannot be improved upon for safety, inspection purposes and ease of construction.

The transfer switches or breakers are so placed between generators and rotaries that the copper runs are direct with no back or side runs which would waste copper. Similarly, the direct-current switchboard is located so that the leads from the rotaries to the switchboard and from the switchboard to the outgoing feeders are as short as possible.

The relative arrangement of apparatus as described above is one of the fundamental points in laying out a power house, for just as soon as cable and bar runs are made direct and short, simplicity and economy result.

The turbo-generator leads are so brought out at the generator terminal boards that the six phases have the proper relation to each other, thereby avoiding crossing of copper bars on the runs to the rotaries.

Problem of Handling Cables at Switchboards

The switchboards are arranged so that the control panels are on the same floor level as the machines, which allows the operator to stand in a position where all machines can be viewed. The auxiliary switchboard is also on this level. The direct-current feeder panels are arranged in the basement at the end of the building, at which point the main feeders are carried into the underground conduit system. The main control board has on its face a mimic busbar in order to show the operator just which switch he is handling. The circuit breakers are solenoid-operated, since practically all the breakers are of high amperage (from 2000 amp. to 10,000 amp. per pole). The circuit-breaker panels are mounted on "I" beam supports in place of the usual angle or pipe framework because of the great strain resulting from the closing of such large breakers.

It will be noted that all the cables that come up to the auxiliary and control switchboards are brought to a cable trench installed immediately back of the board. This allows the cable and conduits to be run in a straight line, making the majority of the transfers and side runs inside the cable trench. The plan also allows a very simple arrangement for the iron conduits which carry the control cables from the various panels to the solenoid-operated switches and circuit breakers in the basement.

The feeder cables from the direct-current switchboard are brought into a cable pit where they are properly arranged for distribution into the outdoor underground conduit system.

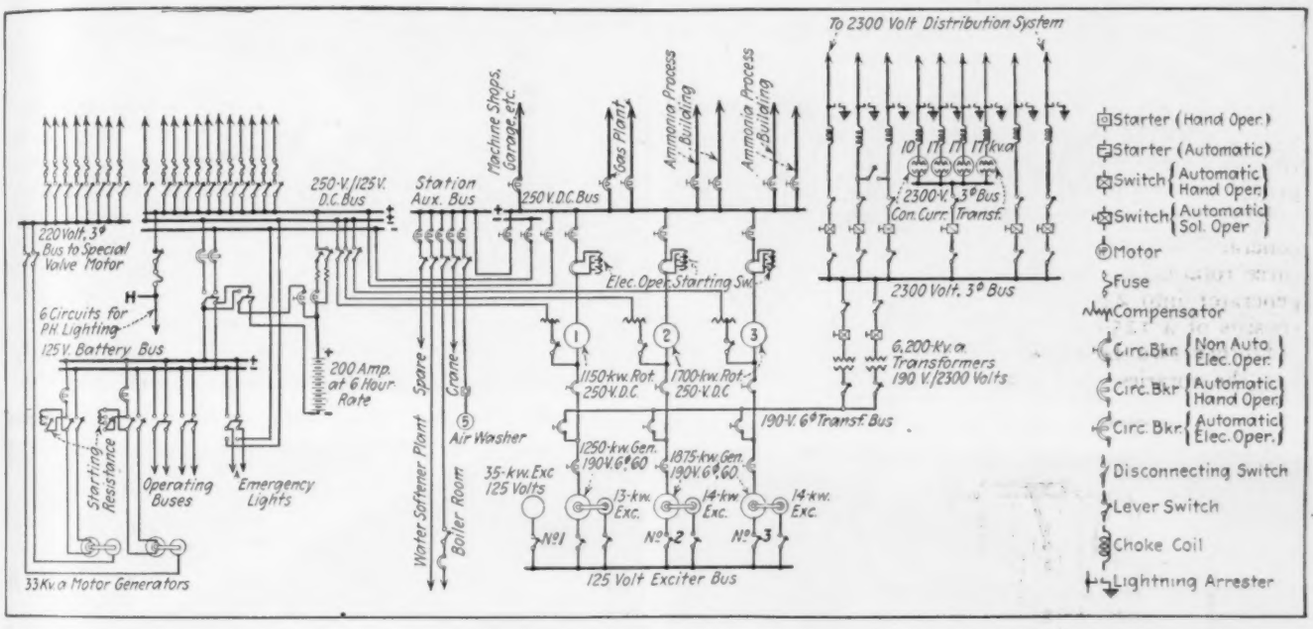


FIG. 2—WIRING SCHEME GIVING GENERATOR AND ROTARY CONVERTER CONNECTIONS, TOGETHER WITH TYPICAL FEEDER ARRANGEMENT

Storage Battery for Emergency Service

A sixty-cell storage battery having a capacity of 200 amp. for six hours is installed on the gallery above the main control board. The purpose of this battery is to supply operating current for the solenoid-operated switches and also to furnish power to the 33-kva. motor-generator sets. These motor-generator sets are equipped with 125-volt direct-current motors and 220-volt, three-phase generators. These generators supply current to fourteen ¾-hp. motors in the process building. The motors are geared to valves which are controlled by means of float switches, and it is absolutely essential that the valves be operable at all times, especially when the main power supply fails, in order that the solutions, etc., in the process building may be automatically taken care of in case of a shutdown. The battery has a capacity great enough to drive one of the motor-generator sets for a period of four hours with a load equal to that produced by the operation of all the valves.

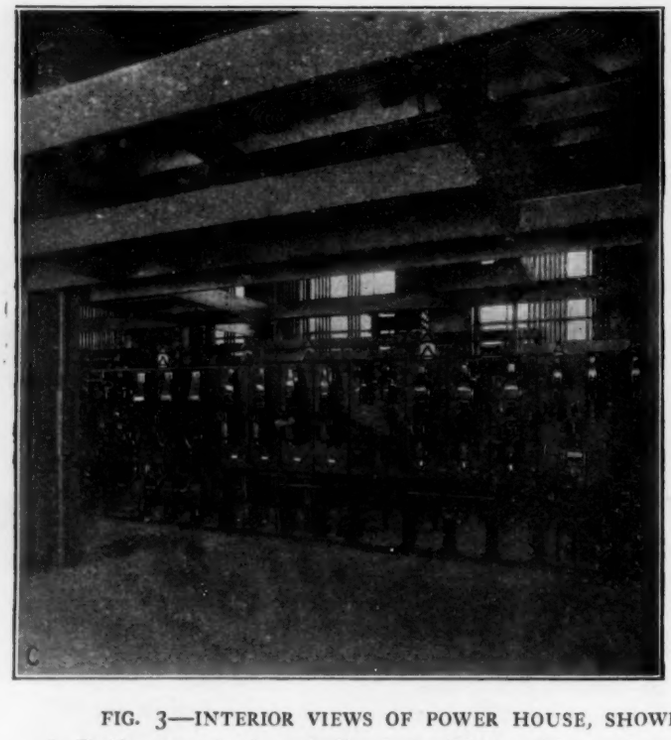
The only motor-operated machines in the boiler room consist of two 15-hp. coal-crushing motors, two 20-hp.

conveyor motors, two 35-hp. flight conveyor motors and one 2¼-hp. Leary crane motor.

These motors are all situated above the coal bunkers. The starting rheostats are hand-operated and are on the main boiler-room floor, and the switchboard panels controlling these motors are adjacent to the starting rheostats. On these switchboard panels each motor is supplied with carbon circuit breakers in place of the usual fuses. This is more economical than fuses and has worked out very satisfactorily. A push-button station, installed close to each of the motors, is in the circuit of the low-voltage release on the starters and permits the maintenance man to shut down any of the motors from his position above the coal hoppers without the necessity of signaling or going downstairs to perform this function.

"Daylight" Lamps for Turbine-Room Illumination

The lighting has several unique features. One is the absence of all bracket lighting on the main floor. This is particularly interesting in that since the side walls are tile it would have been difficult to install conduit. It would probably not be ornamental to have bracket fix-



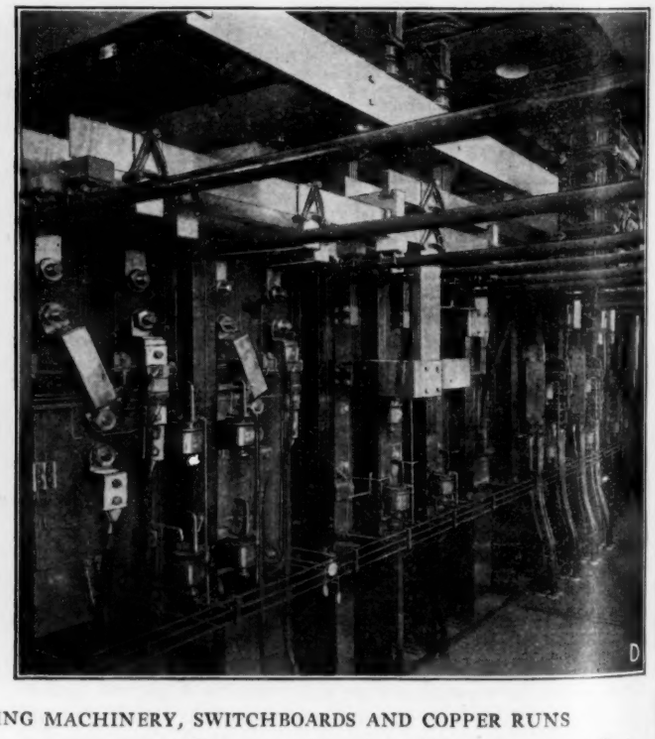


FIG. 3—INTERIOR VIEWS OF POWER HOUSE, SHOWING MACHINERY, SWITCHBOARDS AND COPPER RUNS

A—Turbine room, showing units Nos. 1, 2 and 3, steam-driven exciter and motor-generator set. B—Switchboard end, showing converters and special motor-generator sets. Note storage-battery room and visitors' gallery above switchboard. C—Main direct-current switchboard in basement. Copper and conduit are supported overhead in a systematic and neat arrangement. Note the steel box into which cables run for disposition on switchboard above. D—Rear view of direct-current switchboard. Note the heavy copper work from the converters on the floor above, also the supports for the conduit runs just over the top of the switchboard.

tures when the lighting can be so well taken care of by units placed on the roof trusses.

The coloring in the turbine room is of such a character that in order to bring out the relative values it was decided to use "daylight" type or blue lamps. The result was extremely pleasing and especially effective in bringing out the red floor tile, contrasting with the green-bordered white tile walls. The steel work, including roof trusses, crane, etc., was painted a light blue, the apparatus a dark green, and the switchboard panels were of black marine-finish slate. All these colors are visible at night as well as in daytime owing to this type of lighting.

The switchboard panels and instruments were illuminated by means of angle reflectors of a special design to give a uniform distribution for this purpose. The absence of glare, together with the absence of shadow on the motor scales, was well taken care of with this arrangement.

That portion of the basement under the turbines was particularly difficult to illuminate on account of the large amount of piping. A very satisfactory arrangement was made by installing bracket lights on the columns where ceiling lights could not be easily used.

Lighting in the boiler room was taken care of by means of very large ceiling units and supplemented by brackets on the walls and special lamps with reflectors at the water and steam gages.

EFFICIENCIES OF TURBO-GENERATORS

Tests of the turbo-generators and synchronous converters revealed the following results:

EFFICIENCES OF TURBO-GENERATORS AND CONVERTERS

Units Nos. 2 and 3:

Kva.	Load	Lb. Steam per Kw.-hr.*	Amp.	Volts	Power Factor, per Cent	Phases
1875	Full	15.6	3280	190	100	6
1405	¾	15.7	..	..	..	..
937	½	16.4	..	..	..	..
Unit No. 1:						
1250	Full	16.0	2190	190	100	6
1000	5/6	15.9	..	..	..	..
750	..	16.4	..	..	..	..
500	1/3+	17.8	..	..	..	..

Synchronous converters, units Nos. 2 and 3:

Kw.	Full Load	¾ Load	½ Load	Amp. Full Load	Volts, D.C.
1700	95.0	94.2	92.5	6800	250

* Pressure 190 lb. per square inch, 125 deg. Fahr. superheat. Turbine equipped for automatic steam extraction at 10 lb. per square inch. Back pressure, 2-in. absolute.

There are twelve panels in the main control board, nine in the auxiliary board, twenty-six in the direct-current feeder board, fifty-four in the alternating-current circuit-breaker assembly, two for transformers and five for boiler room, totaling 108 panels in the power house, not including the alternating-current switch structure.

The main electrical apparatus in the power house consisted of:

One 1250-kva., six-phase, 190-volt, 60-cycle turbo-generator and 13-kw. exciter.
Two 1875-kva., six-phase, 190-volt, 60-cycle turbo-generators, 14-kw. exciters.
One 1150-kw., 250-volt, direct-current rotary, six-phase, 190 volts, alternating current.
Two 1700-kw., 250-volt, direct-current rotaries, six-phase, 190 volts, alternating current.
Two 33-kva. motor-generator sets 125 volts, motor direct current, 220-volt, three-phase generator.
One 35-kw. steam turbo-exciter, 125 volts.
Six 200-kva., single-phase, 190/2300-volt water-cooled transformers.
Storage battery, 125 volts, 900 amp.-hr.
Coal-handling motors, two 15-hp., two 20-hp., two 35-hp., one 1¼-hp., direct-current.
Water-softening motors, two 15-hp., one ⅜-hp., one 2-hp., direct-current.
Air-washer-pump motor, 5-hp., direct-current.

The power house was designed and constructed by the J. G. White Engineering Corporation working in close coöperation with the Nitrate Division, Ordnance Department, United States Army, and the General Chemical Company. Work was started Oct. 22, 1917, and power was generated June 10, 1918. The plant was entirely completed within one year's time, despite the great difficulty in obtaining material and labor.

GROUND-ROD ELECTROLYSIS CAUSED BY ELECTRIC RAILWAY

Leakage of Current from Defective Bonds on Electric Railway Causes Failure of Ground Rods of Transmission Line

BY HARRY RESTOFSKI
West Penn Power Company, Connellsville, Pa.

On finding that ground rods placed ten sections apart on a 22,000-volt line of the West Penn Power Company of Connellsville, Pa., were in need of replacement much sooner than would seem necessary under ordinary circumstances an investigation was made which determined the cause of the trouble.

It was found that it was most prevalent on lines paralleling a railway system. On such sections tests showed a difference of potential of from 15 volts to 25 volts direct current between the end of the high-tension ground wire and the negative railway bus in the substation. The current flowing down the ground rod nearest the station varied from 0.1 amp. to 0.4 amp., depending on the position of the cars and the moisture of soil.

When a wire was connected from the end of the high-tension ground wire to the negative bus in the station, a current as high as 8 amp. was observed in the wire while the current in the ground rod nearest the station changed from 0.3 amp. down the rod to 0.1 amp. up the rod. This would indicate that some of the current flowing from the high-tension ground wire through the ground rods and the earth to the direct-current negative bus was taking the low-resistance metallic path from the last pole to the negative bus, rather than the higher-resistance earth path.

The other end of this section showed substantially the same results although the values were not so high. Tests made at other points showed much higher values. Points were found along the line where the track was always negative to the ground wire and vice versa, and other points where the polarity varied with the position of cars.

The tests showed quite conclusively that the railway bonds were defective in places, causing a leakage of current from the track to the high-tension ground rods. This current was carried along the high-tension ground wire to the end of the sections and thence through the earth to the direct-current negative buses in the substations, or, where lower resistance paths were available, through these to the track.

Electrolysis in a comparatively short time destroyed the ground rods that were always positive to the rail, while the others had a life that depended on the polarity and the amount of current flowing from them.

Limitations in Design of Turbo-Generator Units

It Is Considered Practicable to Build Generators Up to 100,000 Kw. for Moderate Speeds, but the Economical Size of Single-Unit Steam Turbines Is Limited and Multiple-Unit Construction Results

SPEED and power limitations as they affect the design of modern steam turbines and electric generators were discussed at the 355th meeting of the A. I. E. E. held in New York on Nov. 14. It was generally agreed that generators can be built in units as large as even doubling the present size of power plants might require. In the case of turbines, however, it appears more economical and practicable to rely upon multiple units for very large capacity. Where the vacuum is very high the last stage of turbine must be designed to provide for the very great volume of expanded steam in the last stage. In modern designs peripheral speeds approach 5 miles (8 kg.) per minute in alternators and 10 miles (16 kg.) in turbines. Generator design was discussed by F. D. Newbury, of the Westinghouse Electric & Manufacturing Company, while Eskel Berg, of the General Electric Company, and J. F. Johnson, of the Westinghouse Machine Company, dealt with turbine limitations.

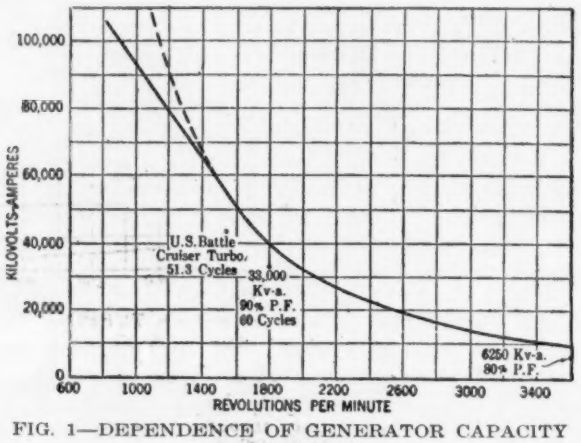


FIG. 1—DEPENDENCE OF GENERATOR CAPACITY UPON SPEED

In dealing with the limitations of speed and output for single-shaft turbo-generators, Mr. Newbury stated that, reduced to the simplest terms, maximum output at any speed is attained when slot space is provided for the maximum possible ampere turns (in either stator or rotor) and core cross-section is provided for the maximum possible flux. These conditions require the most effective rotor diameter or stator bore and the maximum rotor and stator core length. As the rotor diameter is increased with a given speed, there is more room for both winding and flux; but with increase in diameter each pound of copper exerts an increasing centrifugal force and the ratio of slot area to tooth cross-section must be decreased in order to keep within desired stresses. Beyond a certain peripheral velocity ampere-turns must be decreased in spite of the increase in available space, and the most effective diameter has been passed. It would seem, therefore, that in order to obtain maximum output at a given speed the rotor proportions must be chosen to balance properly mechanical stresses, rotor ampere turns and flux.

In certain cases the rotor is the limiting member, and in other cases the stator is the limiting member. In general, the rotor first reaches its limit in ratings of 1500 r.p.m. and higher speeds, and the stator first reaches its limiting output in ratings of 1200 r.p.m. and lower, considering commercial frequencies. Voltage regulation, on the other hand, has ceased to be a limit to output, since regulators can readily handle a range of one to two or one to two and a half, and large generators are proportioned to meet this ratio of no-load to full-load excitation. These field and armature proportions result in regulations of roughly 25 per cent at 100 per cent power factor and 40 per cent at 80 per cent power factor. Obviously, such regulations could not be tolerated if regulation were a factor in operation.

Regarding speed, Mr. Newbury said that American practice has established 400 ft. (120 m.) per second and an upper limit of peripheral speed for maximum ampere turns and output for rotational speeds of 1500 r.p.m. and higher. This, of course, assumes existing rotor materials and factors of safety.

The limiting ratings given in this paper were based on 150 deg. C. total rotor-winding temperature and from 125 to 150 deg. total stator-winding temperatures. It is not probable that ratings will be increased by increasing the temperature limits. Higher temperatures would be of most value in connection with rotor winding since the rotor limits rating in the two-pole and four-pole designs commonly used. But temperatures higher than 150 deg. result in relatively little gain in rotor ampere turns on account of the rapid increase in resistance of the winding.

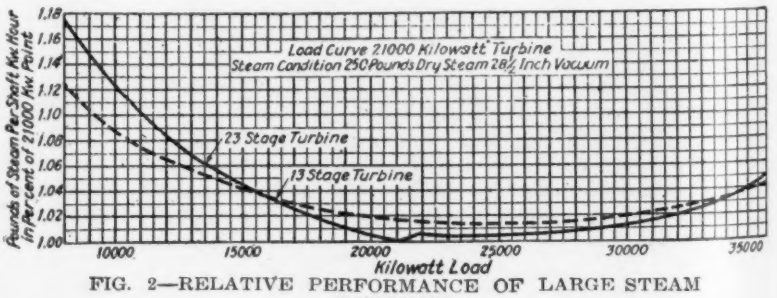


FIG. 2—RELATIVE PERFORMANCE OF LARGE STEAM TURBINES

Temperatures much above 150 deg. in connection with very long rotors are not considered favorably on account of the danger of trouble from "creeping" of the winding caused by linear expansion.

PRESENT BOUNDARIES OF GENERATOR CAPACITIES

Fig. 1 shows in curve form limiting generator capacities at various speeds. At 1500 r.p.m. and higher the capacity is determined by the rotor and is inversely proportioned to the r.p.m. squared. At lower speeds the capacity is limited by the stator and falls somewhat below the corresponding rotor-limiting capacity as indicated by the dotted

extension of the rotor curve. This curve is actually based on constant core length when, as a matter of fact, the length can within reason be increased as the diameter is increased. The curve ratings, however, represent maximum lengths of core so far employed, and material extensions in core length involve questions of linear expansion that must be very carefully considered. This limiting capacity curve represents capacities that can be obtained with existing commercial materials and without radical changes in stresses and bearing proportions. The curve does not represent limits that may not be exceeded in the future. It is more properly an indication of present boundaries—boundaries that will be extended as our knowledge and experience are increased.

The bare mention of ratings larger than 50,000 kva. raises the question of limits to size of individual generating units imposed by operating considerations, such as the relation between unit and station rating, the extent of the damage in case of winding failures, ability to withstand sudden short circuits and so on.

There is no reason for considering the larger low-speed generators less reliable than the high-speed generators indicated by limiting curve of Fig. 1. As a matter of fact the lower speed ratings can usually be designed, both in stresses and in electrical factors, with more margin.

Mechanical forces developed by short circuit are determined by the short-circuit ampere turns of the armature winding per inch of armature circumference, and to a limited extent by the density of the magnetic field set up by the rotor winding. When stations double in size—stations of 300,000 kva. and 500,000 kva.—become typical of American practice there will undoubtedly be a demand of considerable volume for units of 50,000 kw., 75,000 kw. and 100,000 kw., and if single-shaft units are justified from the turbine standpoint, there is no question that such generators can be conservatively designed and constructed.

Design of Curtis Turbines Considered

In dealing with the present limits of speed and power of single-shaft Curtis steam turbines, Mr. Berg stated that different mechanical arrangements will make practicable different characteristics, and the conditions which he considered apply only to machines of these particular designs.

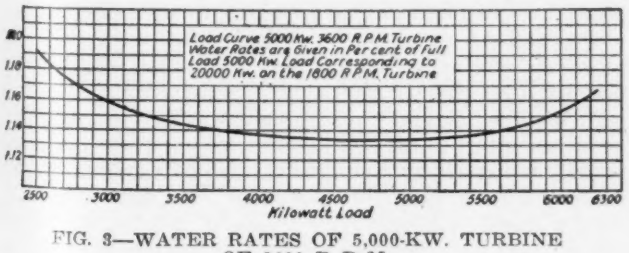


FIG. 3—WATER RATES OF 5,000-KW. TURBINE OF 3600 R. P. M.

The design of turbines must be governed by many compromises, and it would not be possible to give a correct idea as to the whole range of possibilities.

For purposes of illustration two machines were selected, one representative of the largest size built for 1800 r.p.m. and one of the largest size now built for 3600 r.p.m. The figures given relate to the turbine alone and do not include the generators. The turbines in question were of the single-flow type and should be considered representative of capacity limitations of that type, since their construction is that which is adapted to the highest capacity. The single-unit turbine and generator is naturally preferable to the tandem and compound type on account of simplicity, lightness and efficiency. There are, however, certain definite limitations in the size for a given speed of which these units can be built with material available at the present time. The limitation in the size of a unit for a given speed does not depend upon the generator, but is entirely dependent upon the turbine.

Load Curves of Large Turbines Compared

Fig. 2 shows the load curve of the large 1800-r.p.m. machine above mentioned, which is designed to operate with 250 lb. (17.5 kg.) steam pressure, 28.5 in. (725 mm.) of vacuum and dry steam. This turbine has twenty-three stages, all wheels being of the single-bucket type. The curve shows that for 1800 r.p.m. a turbine can be designed for a vacuum of 28.5 in. (725 mm.), giving its best efficiency at 21,000 kw., this point being taken as unity and the water rate at other points being given in proportion. This curve also shows that with a sacrifice of 5 per cent in efficiency an output of 36,000 kw. can be delivered to the turbine shaft. Above a load of 21,000 kw. live steam is bypassed to the eighth stage shell, the effect of which is shown by the break in the curve.

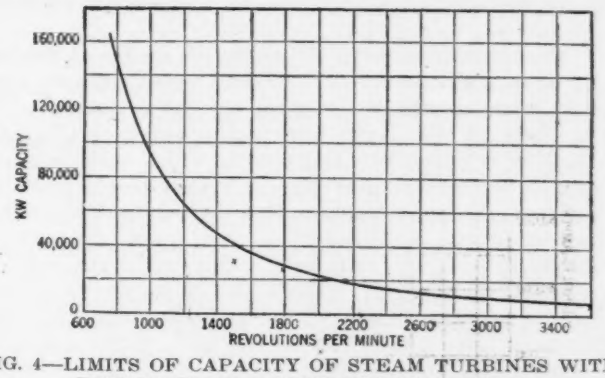


FIG. 4—LIMITS OF CAPACITY OF STEAM TURBINES WITH DOUBLE-FLOW, LOW-PRESSURE STAGES

Having steel blades of uniform cross-section stressed to 25,000 lb. per sq. in. at base of blades at 20 per cent overspeed and maximum efficiency at 80 per cent of rating, 250 lb. steam pressure, 200 deg. superheat, 29-in. vacuum referred to a 30-in. barometer, with steam velocity through blades of 1225 ft. per second at a volume of 585 cu. ft. per lb.

The dotted line gives the load curve of a similar turbine in which the first eleven stages are replaced by one two-bucket stage. This turbine is designed with multiple valve steam admission. Such a modification may be desirable for the purpose of simplification or where better efficiency at very light loads is important, as in the case of propulsion of warships.

Vacuum curves for the 1800-r.p.m., twenty-three-stage machine at 21,000 kw. and 36,000 kw. load on the turbine shaft were shown. From these it was found that the improvement in the economy at a load of 21,000 kw. is 2.5 per cent between 28.5 in. and 29 in. (725 mm. and 737 mm.), whereas with a load of 36,000 kw. due to congestion of the steam passages the gain is only 0.55 per cent.

Great Volume of Steam at Last Stage

Many large-size turbines are now designed for a vacuum of 29 in. (737 mm.). The volume of 1 lb. of steam at this vacuum is 652 cu. ft. (18.2 cu. m.), almost 50 per cent greater than at 28.5 in. (725 mm.) and about twice as much as at 28 in. (711 mm.), which calls for a corresponding increase in the area of the steam passage in the last stage wheel. If this area is made too small, the steam when leaving the last row of buckets must have a high velocity, which

gives a large loss of energy, this loss being in proportion to the square of the velocity. It is, therefore, important that this area be made as large as possible and that the exit angle of the blades be made small enough to give good extraction.

Efficient action can only be accomplished by using a bucket speed that bears a proper relation to the steam velocity. Consequently, to get the largest capacity we must not only use long buckets but must move them at a very high speed. In order to obtain good bucket action, the buckets should not be more than about one-fourth as long as the pitch diameter of the wheel. If they are made longer than this, poor bucket action with consequent loss in efficiency will result, due to the great difference in peripheral speed between the base and the tip of the bucket, the design being made correct for the middle point or pitch line.

Since for the reasons given above the design of the last stage in such a turbine constitutes the most important limitation, some details are given of the design used for the last wheel of the large twenty-three-stage, 1800-r.p.m. turbine which has been mentioned. This turbine is designed to operate at 250 lb. (17.5 kg.) steam pressure, 28.5 in. (725 mm.) vacuum, and dry steam. The pitch diameter of the wheel is 88 in. (223 cm.); length of buckets, 22 in. (56 cm.), and bucket angles 60 deg. entrance and 40 deg. exit. The wheel is subject to the following stresses in pounds per square inch at normal speed: Stresses in hub, 23,450; stresses in web, 22,950; stresses in bucket, 20,100.

Elastic limit (limit of proportionality) of material, 55,000 lb. per square inch. The material of the wheel and bucket is quenched and tempered 3 per cent nickel steel. Experience shows that, in the absence of a tendency to form fatigue cracks through vibration, overspeed in such turbine wheels involves relatively little danger as compared with other types of high-speed machinery. The cure for these difficulties is to use stiffer wheels, and such wheels can carry stiffer buckets, so that the whole structure is incapable of vibration of any amplitude through such forces and periods as arise from the conditions of operation.

Fig. 3 gives a load curve of a smaller 3600-r.p.m. turbine. The water rates are here given in reference to that of the larger machine, the load of 5000 kw. corresponding to that of 20,000 kw. on the 1800-r.p.m. turbine. This turbine has only five stages, one two-bucket wheel in the first stage, the other four stages having single-bucket wheels. The first wheel has a pitch diameter of 35.5 in. (89 cm.) and the remaining four wheels a pitch diameter of 51 in. (129 cm.). The bucket height of the last wheel is 9.125 in. (23.16 cm.), the turbine being designed for a maximum of 6250 kw.

The reason for such a discrepancy in the number of stages calls for explanation. As the output of a turbine, keeping approximately the same stresses, goes up inversely as the square of the r.p.m., if the same number of stages could be used and clearance and all dimensions proportionately reduced, a 5000-kw. machine at 3600 r.p.m. could be made nearly as efficient as a 20,000-kw. machine at 1800 r.p.m. Constructions, however, which are practicable on a large scale are not practicable on a small scale, and consequently there are difficulties in getting the space economy in small high-speed machines which would be necessary for accomplishing the result stated.

It will be seen from this paper that for a given speed there is one particular size of turbine which can be designed to be most economical as to steam consumption, weight, space and price per kilowatt. Even if a size smaller than this is required, it would in many instances pay for the central station to install the larger unit, even though it would have to run at reduced load for some time before the station load increased sufficiently to utilize the full capacity.

Characteristics of Reaction-Type Turbines

Mr. Johnson then undertook to discuss the limits of speed and power for turbines of the reaction type. With the employment of high vacua such as is the present universal practice, the limit of power of a turbine operating at a given speed will be determined largely by the area obtainable through the last stage for the final expansion and passage of the steam prior to its entering the condenser. The significance of this will be apparent when attention is called to the fact that whereas a pound of steam when entering the first stage has a volume of less than 2½ cu. ft. (0.7 cu. m.), when passing through the last stage it has a volume of approximately 395 cu. ft. (11.0 cu. m.) when expanded to 28.5 in. (725 mm.) vacuum, and 585 cu. ft. (16.7 cu. m.) when expanded to 29 in. (737 mm.)—a ratio in the latter case of 1 to 234.

Throughout the entire turbine, with the exception of the last few stages, steam speeds only about 25 per cent in excess of the corresponding blade speeds are employed in order to secure maximum efficiency. In the latter stages, however, the volumes become so great that a compromise between maximum theoretical efficiency and physical dimensions becomes advisable by increasing the steam speed sometimes to approximately 100 per cent in excess of the blade speed.

The steam area is ordinarily expressed as a ratio of the perpendicular distance between blades to the pitch of the blades. Highest actual efficiency is obtained by keeping this ratio between 0.25 and 0.3, and this is done in all stages except the last few in high-vacuum machines, where it is increased to a maximum of 0.5, the equivalent angle being about 35 deg., which includes proper allowance for blade thickness, this ratio having been determined upon as a proper compromise between cost of increased blade height and loss of efficiency due to increased terminal loss.

Chief among the physical factors limiting turbine capacity are the physical characteristics of the materials employed and the chosen limits to which these materials may be safely stressed. While alloy steels possessing exceptionally high physical characteristics are procurable, their high qualities depend on relatively sensitive metallurgical processes which in the opinion of some engineers cannot as yet be carried out by regular workmen as a manufacturing process with a sufficient degree of reliability to justify their use, and until this can be done it is held that conservation demands adherence to the lower-strength, less sensitive materials. Such materials may, with suitable forms of construction, be safely stressed under the maximum test condition to within a few thousand pounds of their true elastic limits.

Specifications for Steel Used in Turbine Rotors

The steel regularly used by the Westinghouse company for turbine rotors conforms to the following characteristic specifications:

Test rings taken as close as possible to the point of maximum stress must show the following characteristics with standard 2-in. (5-cm.) specimens: Tensile strength, 65,000 lb. to 70,000 lb. per square inch; true elastic limit,

22,000 lb. to 25,000 lb. per square inch; elongation, 15 per cent to 18 per cent; reduction of area, 20 per cent to 25 per cent. The steel must be of best quality, having approximately 0.25 per cent carbon, 0.50 to 0.60 per cent manganese, 0.25 per cent silicon, and not over 0.025 per cet sulphur or phosphorus.

The limit of stress to which this material is subjected is 20,000 lb. per square inch (1400 kg. per sq. cm.) when operating at a speed 20 per cent in excess of the normal operating speed. This stress is 63 per cent of the minimum allowable true elastic limit, about 46 per cent of the yield point and 21½ per cent of the minimum ultimate strength. In an extreme case of overspeed the rotor drum or solid disk will stretch sufficiently to cause blading to rub to such an extent as practically to destroy it and thus prevent further overspeed before the ultimate strength and elongation of the material is reached.

There exist two interesting relations between the stress at the base of blades, steam passage area through the blades and rotative speed. For any given rotative speed and blade angle the steam capacity or steam area through the blades is directly proportional to the stress at the base of the blades, regardless of the diameter and blade height. This stress can be modified only by unevenly varying the cross-sectional area of the blades, as, for example, thickening near the base. Also for any given stress the area through the blades will vary inversely as the square of the speed.

ADVANTAGES OF MULTIPLE LOW-PRESSURE STAGES

Increased capacity without decrease of rotative speed or increase of stresses may be obtained by employing multiple low-pressure stages. This well-known and popular expedient possesses the merit of permitting high-vacuum turbines to be built at speeds and capacities up to approximately the present limits of generator construction without exceeding moderate diameters, blade lengths and stresses.

Fig. 4 shows approximately maximum capacities at various speeds which are physically possible, employing double-flow construction, without exceeding the limits of stresses previously given. For equal capacities employing single-flow construction the stresses would have to be doubled. The points marked *x* at 3600, 1800 and 1500 r.p.m. represent capacities which have already been built. This curve must not be interpreted as indicating suggested practicable present or ultimate limiting capacities of turbines, but merely as showing a physical relation between speed and capacity with given limiting stress values and operating conditions.

In the larger low-speed structures the physical proportions become such that, using ordinary steel and cast iron, to which we are limited by the metallurgical art, the distortions due to temperature changes and elastic properties of the materials force increased clearances and bracing to be employed in order to maintain equal reliability and rigidity to a degree which causes the cost per kilowatt for a given efficiency to increase with increasing capacity.

Another factor tending to limit capacity of single units is the generating capacity loss resulting from suspension of service for inspection or repairs. In order to avoid this limitation a number of turbine units of capacities varying from 30,000 kw. to 60,000 kw. have been built in which the turbines have been divided into two or three separate compounded elements, each driving its own generator and each capable of operating alone on high-pressure steam in emergencies.

PRINCIPLES GOVERNING RATES FOR RURAL CUSTOMERS

They Should Pay More than City Customers—Company Should Own Lines—Corporation Line Does Not Divide City from Country

The Public Service Commission of Indiana has granted a general increase in rates to the Noblesville (Ind.) Heat, Light & Power Company permitting it to increase its earnings from 4.8 per cent on $330,000 to 7 per cent on the same amount. This case established the valuation of the company at a figure in excess of its outstanding securities. The valuation includes: Physical property for furnishing, heat, light and power, $303,000; going value, $20,000; working capital, $10,000; total utility property, $333,000; ice-making property, $6,071; hydroelectric property (dam sites), $25,760; non-operating property, $10,004; grand total, $374,835. Bonds and stock outstanding total $290,000.

The rates for rural customers were raised from a sliding scale ranging from 10 cents to 6 cents per kilowatt-hour to 11 cents to 7 cents per kilowatt-hour, and the minimum charge was increased from $1.25 to $2.50 per month. Moreover, it was ordered that all rural customers pay these rates regardless of whether the customers or the company owned the lines, but it was ordered at the same time that the company pay a fair rent on all the lines until such time as it could buy them. In commenting on this increase the commission said:

"A minimum rate of $2.50 per month will be authorized, which is very moderate considering the value and convenience of the service to these rural consumers and the annual expense of each consumer for electric energy if he maintained a private power plant, not to mention the trouble and annoyance involved.

"It must also be remembered that the cost of furnishing service to these consumers is considerably greater than to city consumers, owing to greater maintenance and depreciation cost and line loss. It is not a satisfactory arrangement for part of the rural consumers to own their own transmission lines and part to receive energy directly from the lines of the utility. Various difficulties will arise concerning the transmission lines which are privately owned. The lines are all comparatively new, and so far there has been little or no maintenance or depreciation expense. When depreciation and maintenance expenses become heavy it will be difficult to agree upon the character of the work that should be done and upon who should pay the costs. Moreover, responsibility for personal injuries and other accidents is not definitely fixed. It would be much better for both the utility and the farmers now owning transmission lines if the utility should own all of them, and steps should be taken immediately by the utility to purchase all these rural lines now privately owned. If an agreement cannot be reached as to their fair value, the commission, if requested so to do, will fix the value in each case.

"The commission will authorize a rate which shall apply alike to all rural consumers, whether the lines are privately owned or not. In cases where the lines are privately owned petitioner should pay to the owners a reasonable rental for the use thereof until they can be purchased."

The commission also ruled that the distinction between urban and rural customers should be determined, not by the corporate limits of the city, but by the character of the distribution lines necessary to serve them.

Self-Interest Will Aid Electrical Development*

The Problem of the Industry Is to Have the Public Understand What the Industry Is Doing for the Nation—Telling the Message to Every Individual

BY A. E. WISHON
Assistant General Manager San Joaquin Light & Power Corporation and President Pacific Coast Section, N. E. L. A.

ASK an electrical man what the most important problem of the electrical industry is to-day and his answer will probably depend on the part he is playing in that industry—whether he is an electrical inventor, a manufacturer, jobber, contractor, manager, engineer or accountant. That answer will be based upon vision governed by self-interest. The following points may at the present day be considered as electrical axioms:

1. Central-station development is the thermometer that indicates the degree of prosperity of the entire electrical industry.

2. Electrical development requires financing. To finance, a protected investment and a fair return are necessary.

3. If electrical development is to continue, fair, fearless legislation, national and local, is necessary.

4. Legislation usually represents the opinion of the voter.

5. Legislation should represent the opinion of the voter—it is a fundamental of our democracy.

With these electrical axioms in mind, I answer the question: The greatest problem that faces the electrical industry to-day is that of having the public understand what the electrical industry is doing for the nation.

If the conscience of the electrical industry were not clear—if we of the electrical industry were not convinced that our industry could stand the acid test of analysis, of its efficiency in serving the public, of bettering the standards of living, of being the basis of future progress, it would be as well that the public did not understand.

Picture the world of to-day and then take from it the electrical development of the last thirty years. Try to visualize it. Concentrate upon it, until you can see clearly the picture of that world as it would be without the comforts of life, without adequate means of communication or transportation, without electric light or power, and without possibilities.

Our industry is that great electrical scheme that makes the world of to-day possible, on which every line of business, the comforts of the home, the efficiency of production and the standards of the living of the future, must depend.

The public will not take the time to interest itself in the problems that confront the electrical industry, and that public understanding and interest can be brought about only when we make the problems of the electrical industry the problems of the individual of the public by proving to the individual of that public what the electrical industry is doing for him—what further development of electrical industry means to him in dollars and cents gain, and what a delay in electrical development means in dollars and cents loss to his individual business.

As a Westerner I will speak of conditions West. I am forced to use several curves of the San Joaquin Light & Power Corporation, as these are the only curves I have available at this time. But the theory of interesting the public in electrical development by self-interest is applicable North, East, South and West, and at this time the Pacific Coast geographic section committees of the National Electric Light Association are superimposing curves of the different Pacific Coast companies that will tell the story of what electrical development of the Pacific Coast means to the public.

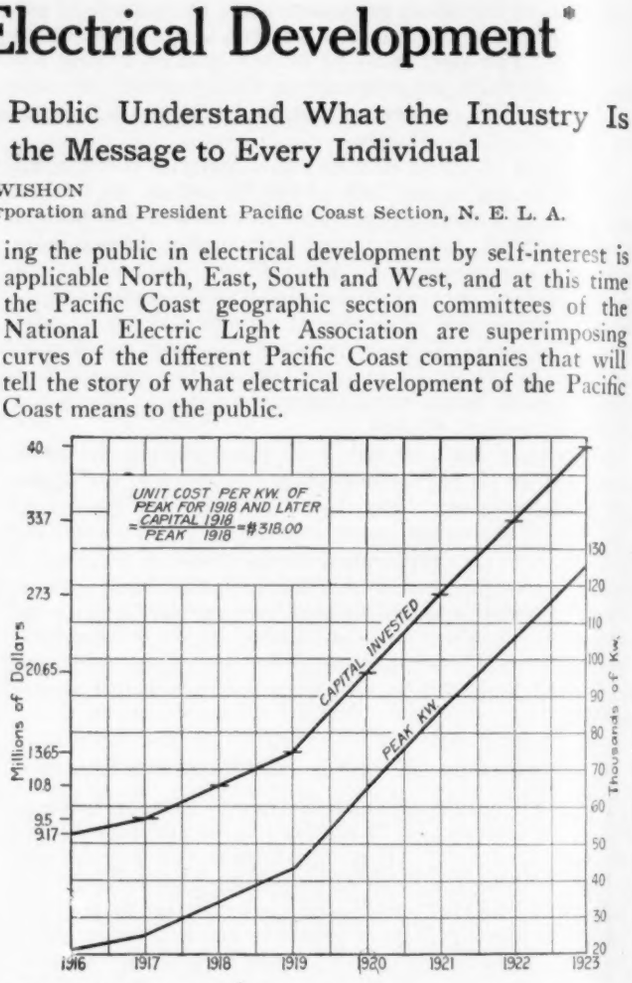


FIG. 1—ESTIMATED PEAKS OF SAN JOAQUIN SYSTEM

Capital invested as plotted is exclusive of real estate, material and supplies on hand, current assets, open estimates, sundry inventory accounts and automobiles.

We who have studied the problems of the development of the West know that the West will not develop ahead of its hydroelectric development. The greater portion of the Western territory depends upon hydroelectric pumping for irrigation of its arid lands, if agriculture is to be further extended. If factories are to be built in the West, cheap power must be obtainable.

Any form of legislation, national or state, that delays electrical development delays the development and prosperity of the West and of the nation, and any thinking electrical man can sit down and figure out just where any particular business loses in dollars and cents when hydroelectric development ceases. Prove your case to the individual by proving where that individual's pocketbook is hurt when your business is hurt, and you will have a convert who will see that your business shall prosper.

When electrical development ceases the prosperity of the contractor, dealer, jobber and manufacturer ceases. When electrical development is encouraged their business is encouraged.

This Western country is yet electrically unsaturated and will be for many years to come, and the engineers and commercial men of the different companies have plotted their anticipated load curves, based upon past experiences, several years into the future. Superimposing these antici-

* Address delivered before prominent engineering bodies on the Pacific Coast.

pated load curves, we have before us a graphic proof of just what increase in kilowatts we can expect for this territory for the future, if proper encouragement is given to electrical development.

Next, dividing our electrical investment of to-day by the total kilowatt load gives us the unit cost per kilowatt of investment. Taking the cost per kilowatt installed, it is a simple matter to multiply the increased load for any future year by this unit cost and determine the moneys to be spent in electrical development in the West for any future year.

Next, with our standard classification of accounting, as set up by the state regulating commission for public utilities, it is a simple matter of mathematics to determine the amount to be invested in generators, dams, transformers, copper, etc., that, under normal conditions, the Pacific Coast will require during any period in the future.

These data are all available. It is simply a matter of putting them together in a graphic plan that will prove to the individual and to the different interests what electrical development means to each one in dollars and cents.

For instance, you are a manufacturer's agent. I show you by definite, graphic proof that under conditions of encouragement a certain load can be added on the Pacific Coast in 1920; that, based upon past costs of construction, the building of plants necessary to take care of this load will require a definite number of millions of dollars, and next, you are shown that, according to the averages of the classified investment for the past, approximately 8 per cent of this total investment will go into transformers. What will you do?

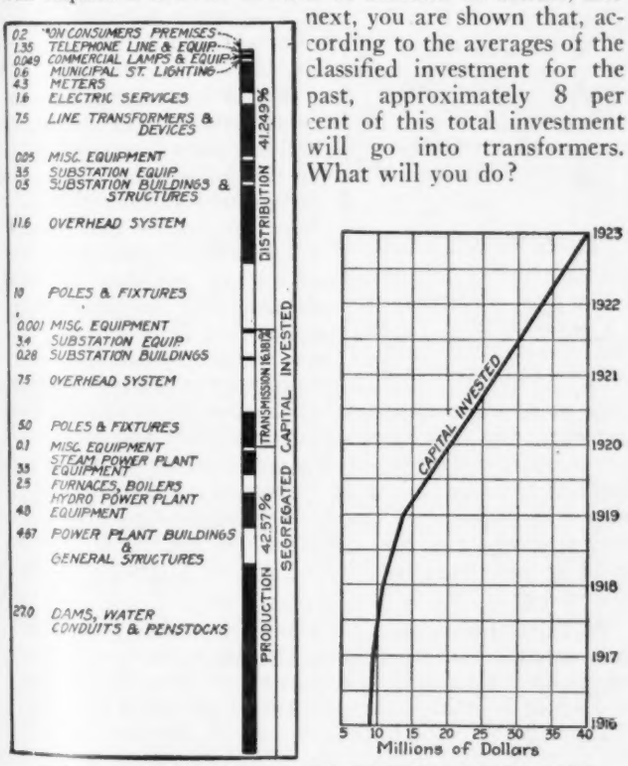


FIG. 2—SEGREGATED INVESTMENT OF THE SAN JOAQUIN SYSTEM

Capital invested as plotted is exclusive of real estate, material and supplies on hand, current assets, open estimates, sundry inventory accounts and automobiles.

If you are a live manufacturer's agent, you know what part of the transformer business on the Pacific Coast should be yours. You know just what net profits you should make from the sale of those transformers that are to be added to the Pacific Coast if electrical development is encouraged. It means a definite amount of dollars and cents to you, and you are interested to that amount.

You will use every effort to see that electrical development is encouraged. But you will not stop there. You will carry this same message of "self-interest" to the manufacturer of those transformers in the East. You will show him definitely the amount of gross sales he can expect on the Pacific Coast in that particular year. He will be interested and will take up the argument to the extent that he benefits in dollars and cents. He will carry that message "to encourage Pacific Coast development" to the steel mills from which he buys his steel. He will tell it to them on the basis of self-interest, by showing them the amount of steel they will sell him for the manufacture of his transformers that are to go to the Pacific Coast, provided that electrical development is encouraged.

He will tell it to them in terms of what it means to the steel men in dollars and cents gain or loss, depending upon electrical development of the Pacific Coast. Probably half of the cost of the transformers is in labor, and he will tell to his laboring men the story of the definite amount of money that will be poured into factory payrolls if electrical development is encouraged in the West. That man on the factory payroll will be interested in the development of the West just to the extent that it affects his income in dollars and cents.

There are a thousand and one possibilities in the graphic presentation and proof. For instance, I have called attention to only a few points affected by moneys directly spent in electrical development and have even neglected to call attention to the great construction labor payrolls that directly affect the West and go to those that carry on the construction of the great properties.

To cover just another angle of the situation, let us leave the direct benefits of construction moneys expended and turn to the effect of those kilowatts when put into operation.

We have our segregated classes of consumers for the past, and if 100,000 kw. is to be added in this state for 1921, it is not hard to determine what increase will occur in the different classes of consumers, how many farms would start, how many factories would start and how many new homes would be connected. This added business means material sales for the general merchandising interest, means added payrolls to the different trades during construction of the different industries, means continued production, continued factory payrolls and continual sales to the new population that comes into the territory to carry on the operation of the different lines of business made possible through further hydroelectric development.

You may agree that the argument is logical, but you may ask, "Can it be applied to 'our' company?"

As I said, I must discuss conditions West. I will use only a few simple curves of the San Joaquin Light & Power Corporation, but will leave it to men of the electrical industry, men of vision, to say whether or not the theory of interesting by self-interest is practicable and applicable to any company.

That you may judge the theory from different angles, study the three simple curves I offer—first, from the standpoint of the Eastern bond house, as to the market the West offers for moneys; second, from the standpoint of the electrical jobber and the market the West offers for electrical supplies; third, from the standpoint of the electrical manufacturer and the market that the West offers

for supplies; fourth, from the standpoint of any of the different local industries that depend upon electrical development.

I will discuss these curves from only a few points of view; but when you once have the idea, you can then take your own plant conditions and can develop from these simple curves (of your own plant) hundreds of different graphic presentations, showing how your electric development will affect the different lines of industry.

For your general information I will say that this company is at the present time working night and day on a new 30,000-kw. hydroelectric plant that is expected to be in operation in August, 1920. We are also rushing to completion a 12,500-kva. steam plant to take care of the spring load of 1920. At the same time five engineering crews are completing the survey of a hydroelectric development that, when completed, will generate 160,000 kw. It is the same the West over. The public is clamoring for service. The utilities are making every effort to serve.

I call your attention to Fig. 1. On this are shown the estimated peaks of the San Joaquin Light & Power Corporation system, from 1916 to 1923. On this is also shown the capital to be invested during the same interval to make available that plant capacity. This capital investment curve represents only such capital as will be invested in plant installation and takes into consideration no rights-of-way, franchise or other costs.

It is of interest to the bond house that this company will require $26,000,000 in the next four years in hydroelectric development. It is of interest to the jobber and manufacturer that $26,000,000 will be spent in electrical development and that a definite portion of that amount will go into electrical supplies. This amount from a single company gives some idea of the investment that will be made in electrical development by the Pacific Coast and by the nation under proper encouragement.

Next, I call your attention to Fig. 2, a self-interest diagram that should appeal to every branch of the industry and is particularly interesting to you, the manufacturer and the jobber.

This is based upon segregated investment of the San Joaquin Light & Power Corporation system. Such segregation could be carried into greater detail under the standard classification of accounts, but this curve will give you sufficient segregation to show you what this company's development in the next four years means in the sale of different classes of electrical equipment.

The first item that you will consider on this diagram is the item that affects your business. That is what proves that the theory of interesting by self-interest is sound. I ask bond men, manufacturers and jobbers if they can see why they are directly interested in encouraging electrical development, and if it is to their best interests to bring about a better understanding with the public as to what electrical development means to every citizen.

Next, we will consider an entirely different phase of what electrical development means to the public. That is, the result of those kilowatts when put into operation.

Your classified consumers' curve, extending over any period, will show you the number of consumers of different classes that should connect with your system during that period; but in my next presentation, I wish to take a more definite example.

At the present time the San Joaquin Light & Power Corporation has over 2000 applications for power service, of which 1200 are applications for agricultural service. A close study of the agricultural applications indicates that approximately 600 of these applications are for the development of new lands, requiring new homes, barns, buildings, fences and all farm equipment.

In Fresno County, in 1910, there were 16,799 homes, and there were 6245 farms, or approximately two homes in town for every home in the country. It is therefore apparent that when electrical service is rendered and the 600 new farm homes are constructed 1200 in-town homes will be constructed or 1800 additional homes will be built, due directly to electrical development; and this does not include commercial buildings, factories and other resultant construction that is made necessary to handle the produce of the 600 farms and to supply the population made possible through this agricultural development.

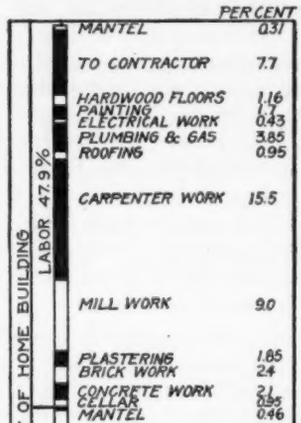


FIG. 3—SEGREGATION OF HOME-BUILDING COSTS

The cost of the average in-town home in this locality, including building site, is $6,000, and for the country home, without building site, $5,070, or a total building construction program of $10,242,000.

Fig. 3 is a segregation on a percentage basis of home building costs that go to make up this investment. It shows definitely just how the different industries and trades will benefit in definite amounts of dollars and cents in this $10,242,000 building program that is dependent entirely upon hydroelectric development in serving a single class of power consumers. Take the lumberman for a moment. Let him figure it out in dollars and cents and see if he is interested in the electrical development of the San Joaquin Light & Power Corporation. Next, with 15.5 per cent of this total investment going to carpenter work, can the carpenter be interested in this building program that depends upon hydroelectric development?

As units of an industry, we have learned to understand that, regardless of the part we are playing in the industry, we are limited in our possibilities of success as the industry as a whole is limited; that what is of benefit to the industry as a whole is of benefit to us. It therefore becomes the duty of every man in the entire industry to carry to every individual of the public the message of what the development of electrical industry means to that individual in dollars and cents; for when that message is put across, as it can be, the public will understand that to delay electrical development delays local and national development in all lines of business, that financing is necessary to electrical development, and that fair legislation is necessary to financing. When the public understands these simple facts the greatest problem that faces the electrical industry to-day will be solved.

Elimination of Insulator Failures

Results of Tests and Experience with Insulators on Transmission Lines in Wisconsin Prove that Constant Vigilance Is Necessary to Detect Faulty Units—Different Methods of Testing and Their Respective Advantages

BY E. J. KALLEVANG
Transmission Line Superintendent.

WHEN the construction of high-voltage transmission lines became a common necessity manufacturers were required to produce insulators according to the following requirements:

1. The insulator must not flash over at normal operating voltage even when wet and somewhat dirty.
2. The insulator should be so designed that it will flash over at an excessive voltage at normal frequency and not puncture.
3. In order to prevent burning of wood poles and cross-arms the surface leakage distance should be sufficient to prevent excessive leakage current.
4. The insulator should be strong enough mechanically to withstand the load imposed upon it.

Operators have found, however, that the foregoing specifications will not necessarily assure insulators that will give reliable service because there seems to be an aging effect that takes place even when insulators are not in service. In other words, some insulators which have passed factory tests and been stored for a few years will not pass tests less severe than those originally imposed. For this reason engineers have become particularly interested of late in methods of detecting insulator deterioration before the units fail.

SOME TROUBLES THAT HAVE BEEN EXPERIENCED

In a warehouse in Kilbourne, Wis., the Southern Wisconsin Power Company had probably 400 disk-type insulators that had never been removed from their crates. In the summer of 1916 these insulators were tested with a megger. About 75 per cent failed and were thrown in the scrap heap. More recently when a shipment of 1200 insulators was received from the factory they were tested on unloading. Five of these tested zero with a megger.

It is very apparent that something takes place inside the metal cap in suspension insulators and between the shells in pin-type insulators that causes these failures whether in or out of service. While much of the deterioration is apparently due to mechanical stresses, it is not impossible, at least in some cases, that the electrical test applied at the factory has something to do with starting this deterioration. For instance, too high a voltage or frequency might damage the porcelain.

Cracking of insulators is by far the most serious cause of depreciation. This cracking usually takes place under the metal cap in suspension units and in the head of the pin type. The predominant factors in this connection are, first, mechanical stresses due to temperature changes necessarily resulting from the different coefficients of cubical expansion of metal, cement and porcelain; second, contraction and expansion of the cement itself, due to the influence of varying moisture conditions, and, third, dielectric flux concentration from improper design in insulator shapes and porous porcelain. Normal line voltage does not usually develop the latter cause of trouble, it being created principally by transients.

Changing neat cement from a dry to a completely moistened state will expand it as much as 0.15 per cent, which is equivalent to a temperature change of about 150 deg. C. Cement briquettes in different stages of aging usually have a number of very fine cracks or hair lines in them. The progressive expansion taking place with the cyclic changes is attributed to the incomplete hydration of some of the particles of cement. The briquettes have been sealed up and protected, but as expansion and contraction go on, more of them are exposed to moisture, so that additional "setting" and a certain amount of permanent expansion takes place. Another form of expansion takes place inside the metal cap. There the difference in the temperature coefficient between porcelain and steel has an effect on the porcelain. The coefficient of porcelain is only approximately one-half that of steel. It can be seen that from this cause alone stresses sufficient to cause damage must occur as the result of temperature changes.

IMPROVEMENTS IN MANUFACTURING METHODS

In modern insulators, especially those of the pin type, improvements have been made along the following lines:

1. Smaller heads with corresponding cement section and area.
2. Fewer and stronger parts.
3. A more elastic joint between parts.
4. Smaller amount of nesting without decreasing mechanical reliability.

Insulators in use near railroad tracks, more especially railroad crossings, show a greater percentage of failures than those not subjected to smoke and gases. While it is possible that insulators in such locations may reach higher temperatures due to the black surfaces or increased surface leakage, which increases the working temperature, especially of the outer surface, it is more probable that the greater number of failures is due to the sulphur fumes in the smoke attacking the cement and increasing the crystalline growth. This crystallization causes expansion and sets up a stress. When this stress is combined with that due to the difference in temperature exceedingly high strains may be produced, which probably accounts for the greater number of failures near railroad crossings.

OPERATING TEST METHODS AND RESULTS

The problem of foremost importance to operating men is to maintain good service over lines having defective insulators. There are two ways to accomplish this. One is to remove all insulators, regardless of insulating value, and replace them with new insulators. This is not always practicable to do because of the large expense involved. Again, it is doubtful if this would eliminate the trouble indefinitely. Defects of the same nature may occur in the new insulators after they have been in service a few

years. The other and more economical method is to locate by tests and discard units showing signs of defects in any degree sufficient to warrant their removal.

There are a number of different methods used for testing insulators, the principal ones being the 60-cycle high-voltage test, the high-frequency or oscillator test and the megger test. The 60-cycle high-potential test has until recently been used for making factory and laboratory tests and is still used to some extent. It is incapable of producing high-frequency wave trains such as are sometimes produced by variation in load, switching, lightning strokes and accidental grounds. It will therefore not always locate such defects as flaws consisting of very fine cracks, air pockets and porosity. If the voltage is raised too high or too fast, damage will result to the porcelain, which does not always prove that the material was defective. The principal value of this method is in determining the puncture and flash-over voltage at normal operating frequency. The high-frequency or oscillator apparatus is capable of producing more nearly the actual operating condition in a line. If used with proper care, it is undoubtedly the best method at the present time.

The method of testing with a megger is the most convenient and has been used for field testing more than any other. The megger method has a number of limitations. It cannot be used successfully on pin-type insulators, floor and wall bushings or any insulators having a large surface. Some indication can be obtained if the insulator is partly submerged in water and the different heads filled with water and tests between the different walls made by inserting the terminals in the water.

The megger is best adapted for use on suspension insulators, by testing between the metal cap and metal pin. If the porcelain under the cap has developed a crack and moisture has entered into that crack, all that is necessary is to generate sufficient voltage to break down the moisture path. This the voltage generated by the megger is capable of doing.

The megger is essentially an instrument for measuring resistance, and it is therefore important that care and judgment be used in making insulation readings, taking into consideration such factors as dust and moisture on the surface of the insulators due to fog, rain or frost. It is very necessary that the air be dry and the surfaces clean, otherwise inaccurate results will be obtained from the surface leakage and insulators will be scrapped which may be good. Reliable results can be expected only under favorable weather conditions and by testers experienced in handling the instrument, men who know its limitations and the precautions to be observed in its use.

Observations from a Specific Case

During the summer of 1916 the insulators on the transmission line between Kilbourne and Watertown were tested with a megger. The insulators are of the disk type, with four disks in series on suspension towers and with five to seven disks in a string on strain or dead-ends. At the time this test was made there were three of manufacturer "A's" and one of manufacturer "B's" insulators in series on suspension towers. The "B" insulators were next to the conductor. The "A" insulators had been in service since the line was put in operation in 1909. The voltage at that time was 44,000. During the latter part of 1914 one "B" unit was added and the voltage raised to 66,000. The strings on the strain towers were either "B" or "C" units or a combination of the two. Accurate records were kept during the test of the reading of each unit, noting its position in the string, phase, make, suspension or strain and line number.

A number of tests were also made at the engineering laboratory of the University of Wisconsin, and one of the things discovered was that the "B" insulator, in proportion to its size, was carrying more than its share of the charging current for the entire string and that the arrangement of insulators in suspension was undesirable. It was then decided while testing and removing the bad insulators to rearrange the insulators so that there would be either four "A" units or four "B" units in each string.

This year the same lines were tested again, and data were kept in the same manner as on the previous test. The total percentage of bad units for both lines and all makes of insulators in suspension and strain was 7.1, a decrease of 2.1 over the test made two years ago. The following table gives the percentage of decrease or increase in bad insulators found in the two tests:

	Failures (per cent)		Per cent	
	1916	1918	Increase	Decreoae
A	10.7	7.1	....	3.6
B*	7.8	5.7	....	2.1
B	4.7	7.1	2.4	....
C†	6.07	12.3	6.23	....

The writer believes that the higher percentage of failures in the top units in suspension strings is due to the fact that the top unit is subject to more abrupt changes in temperature. The lower units are to some extent protected from rain and sunshine by the unit above.

The larger number of failures in strain units may be accounted for by the fact that the cement is more directly exposed to the elements, thus affording greater opportunity for taking up water, causing the cement to expand and contract more frequently than the cement in suspension insulators. Moreover, the greater tension in dead-end insulators undoubtedly contributes toward deterioration.

Recommendations

It can be seen from the results of these tests that frequent and careful inspections of transmission lines are necessary. They should be made by persons familiar with conditions affecting successful operation. When making these inspections the things to look for include trees too close to the line, especially trees that stand at the side of the line and are tall enough to reach out over the wires in case they fall. Trees of this kind that are dead or have been damaged by lightning should be removed. Reports and inspections should be made of insulators that are damaged to any degree and from any cause, of tower foundations and of dirt falling around poles. Oftentimes poles set in soft soil will work loose and sway when the wind blows, causing short circuits between wires. Cross-arms or poles that have been charged by the current from a leaky insulator, broken guys, slack wires and defective cross-arms should be watched for. Poles and cross-arms sometimes develop large cracks from the effects of the weather. The man making inspections and finding broken insulators, or any other part of the line that needs repairs, should take particular notice of the actual conditions, ascertaining if possible the cause of the damage and the time it was done and whether repairs should be made at once. He should also state what tools and material will be needed.

*Suspension insulators. †Strain insulators.

Readers' Views and Comments

The Other Fellow's Profit

To the Editor of the ELECTRICAL WORLD:

SIR: If an electrical manufacturer or his representative told the people of Dubuque, Iowa, that the local central station was making electricity for less than 2 cents and selling it at a tremendous profit for 10 cents, then that manufacturer could expect the Dubuque Electric Company to register a forceful complaint. Moreover, if such a statement were made at a time when the Dubuque company had a rate case pending the crime would be doubly heinous. The charge would be made, and justly made, that the manufacturer was wrecking the industry, that he was hurting the central station's local standing and its business. It would be pointed out to him that he was very short-sighted in making such statements because in damaging the central-station business he was harming the industry from which he received his bread and butter. This might happen in any city, but Dubuque is used for example.

Now suppose again that the central-station manager at this same town hears that electric appliance prices have advanced. Suppose also that a prospective electric appliance customer comes in the day after the raise takes effect and inquires about a new appliance. What will this central-station man tell the prospective buyer about electric manufacturers in general? Will he stand with the industry in defense of the electrical manufacturer? Will he even withhold his decision regarding the justice of the raise until he has heard the facts from the manufacturer or his representative?

Experience has answered these questions. "Profiteers" is probably the least offensive of the terms that too many central-station men will use. Too many central-station men, assisted by the willing prospective buyer, will find many reasons why the prices should not have been raised. In other words, they criticise the manufacturer's business in exactly the same way that they would most surely dislike to see the manufacturer criticise the central station. The whole situation seems utterly silly, yet it is very real. although, fortunately, instances of this kind are not so frequent as they were in the early days of rapid price changes.

The electrical manufacturer's representative has come to know that if he "knocks" a central station it hurts his business and is likely to involve him in personal difficulty. The central-station man, however, being the buyer, feels no such restraining influence. He is free to say what he thinks. Unfortunately his thinking is sometimes obscured by a false sense of public responsibility which leads him to believe that he is the guardian of the public's purse and that he is in duty bound to see that the public pays as little as possible for the electrical goods it buys. He feels this great responsibility when in reality it does not exist. If he handles electrical goods he is not the public's guardian; he is a merchant. And a merchant is a man who buys and sells at a profit.

It would seem therefore that the central-station man who complains about increasing prices on electrical goods is making a mistake. His error is particularly grievous at this time because the public apparently does not care to have any one protect it from fair price advances. All seem ready for the logically higher level of prices that higher wages and higher material costs must bring. Why, then, is it not good policy for central-station executives to instruct their organizations to refrain from criticising electrical manufacturers who raise prices, at least until a fair investigation shows that criticism is justified?

St. Louis, Mo. H. R. WARD.

American and European Practice in Grounding the Neutral

To the Editor of the ELECTRICAL WORLD:

SIR: I note in the issue of the ELECTRICAL WORLD of Sept. 13, page 589, an abstract of "Suppression of Intermittent Earths by Neutral Resistance and Spark Discharger," by W. Peterson. The author makes rather optimistic assertions for the use of reactance in the neutral ground connection.

The question of grounding the neutral of power systems is a very much discussed problem. The practice in this country is tending toward the omission of any resistance or reactance coils, except in the case of very large city distributing stations where the current involved in a short circuit would be large enough to destroy the cable before the circuit breaker could open. In this case it is not American practice to put a high resistance or reactance in the neutral, but a resistance of low enough value to permit the flow of sufficient current to trip the feeder breaker.

It is foreign practice to use a reactance coil in some cases, but, as stated in the abstract just referred to, if a current-limiting device is used the best protection is afforded by a non-inductive resistance rather than a reactance coil. A reactance coil is only good for one thing, in so far as I know, and that is relieving a line of static, and it is used for this purpose to some extent in this country in the protection of telephone lines which parallel high-voltage lines.

The abstract referred to states that the neutral resistance must not be so low that the earth current becomes excessive. This is indefinite, of course, since a current considered excessive on European systems might not be considered so at all according to the standards of American practice. I might state that a great many engineers from all over the world have visited this country in the past few months to get first-hand knowledge of American practice, among them being many French and English engineers.

It is my opinion that in so far as practice is concerned America is far ahead of the rest of the world.

New York. JOHN EDSON KNOWLTON.

WE MUST not think that because our government has been established and has stood for 150 years, because it has weathered foreign war and civil war, that it needs no care and no attention from its citizens. Foreign enemies are not the only enemies that free governments have to contend with. Always there are people who are sheltered and protected by the government but who think that they see some advantage in avoiding some part of its responsibility or in resisting some part of its control. —*Donald McDonald, Louisville, Ky.*

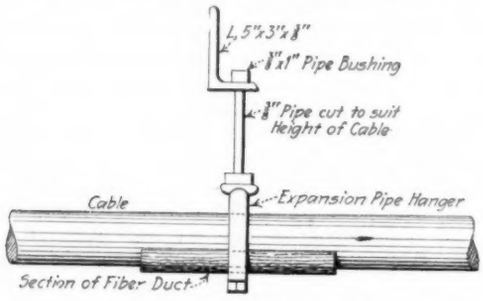
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SIMPLE HANGER FOR USE WITH HORIZONTAL CABLES

The Device Consists of Expansion Pipe Hangers Suspended from Channel Iron by Means of Short Pipe Lengths

In a short horizontal section of a tunnel of the Union Gas & Electric Company of Cincinnati where the cables are not in ducts hangers have been designed to support the cable from channel irons placed near the ceiling. These



CABLE RESTS ON FIBER SECTION WHICH IS SUPPORTED IN PIPE HANGER.

supports consist of Crane expansion pipe hangers that hold a piece of split fiber duct on which the cable rests. The expansion pipe hangers are suspended from the channels by ⅜-in. (9.6-mm.) pipes.

APPARATUS INSULATION TESTS REDUCE REPAIRING COSTS

By Periodic Testing and Analysis of Insulation Depreciation Breakdowns Can Be Obviated—Heat Runs Bring Resistance to Normal

By taking quarterly an insulation reading to ground on all station apparatus—generators, transformers, cables and in fact everything working at a potential above 300 volts, and in some instances the revolving fields of the turbine generators—the Georgia Railway & Power Company has saved considerable money in repair bills. This is accomplished by keeping a complete record of these readings and noting the depreciation of the insulation on any apparatus. In some cases where a machine stands very long out of service it is necessary to short-circuit it and make a heat run in order to bring the insulation resistance up to normal. Especially is this true if the apparatus is situated where the temperature changes are very great.

A convenient way to make these insulation tests is to use a high-reading (700-volt) direct-current voltmeter and a 600-volt battery. This battery can be made very easily by cutting second-hand battery plates into long narrow strips and separating them with perforated hard-rubber strips, the two elements being bound together with ordinary rubber bands. The cells made by placing this structure in 6-in. (15-cm.) test tubes take a good charge and retain it for some time, and a 600-volt battery is small enough to be carried in the hand conveniently, if properly assembled in a wooden case, which should be painted with acid-proof paint. The insulation resistance is taken by connecting a voltmeter in series with the battery and with the apparatus and then trying to pass current through the insulation. After taking the reading the resistance can be easily calculated.

MAKING TAP CONNECTIONS TO TRANSMISSION LINES

How the Johnson Transmission Line Tap Has Been Successfully Used as an Air-Break Switch in Making Connections

T. F. Johnson, general superintendent of the electrical department of the Georgia Railway & Power Company, Atlanta, Ga., has devised the switching arrangement shown in the accompanying illustration for making connections to transmission lines or to other cir-

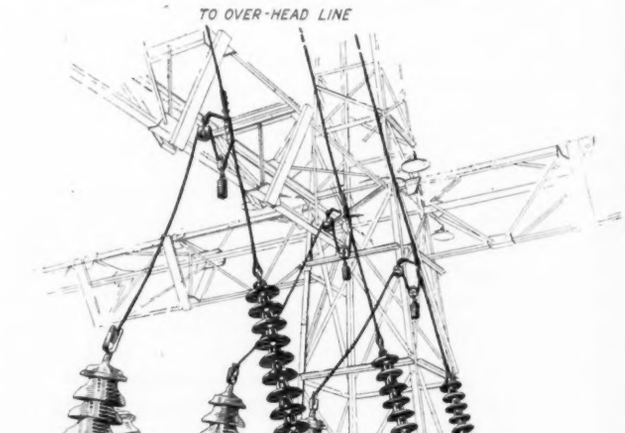


FIG. 1—METHOD OF ATTACHING "SKEET" SWITCHES BETWEEN VERTICAL BUSES AND TRANSFORMERS

cuits where an air-break type of switch is most convenient.

When using this arrangement a stirrup is provided at the insulator of, say, an oil switch. To this stirrup a

Johnson transmission line clamp at the end of a flexible copper cable made up of many strands of small-sized wire is attached. This cable is run over a pulley and weighted as shown in the illustration, so that when the transmission line clamp is disconnected the weight will pull the cable up to a stop placed at such a distance that the transmission-line clamp can be easily reached with a

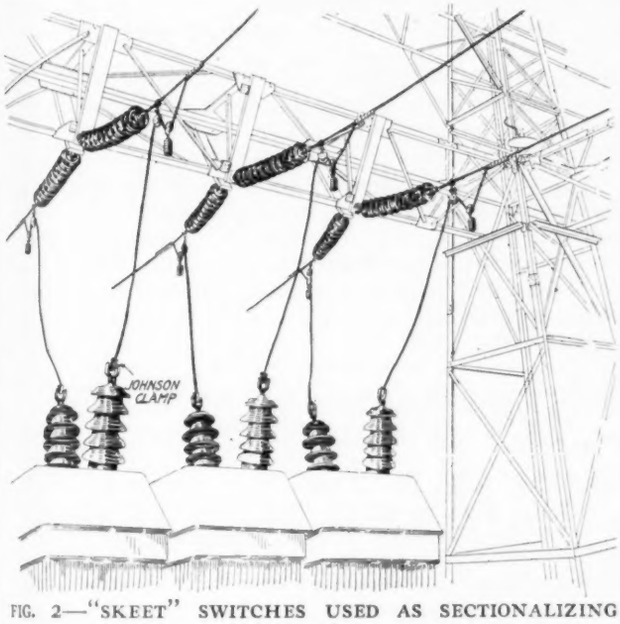


FIG. 2—"SKEET" SWITCHES USED AS SECTIONALIZING SWITCHES

switch stick. The stop used usually consists of a three-bolt guy clamp. Such an arrangement effectually takes the place of a disconnecting switch at about 5 per cent of the cost. This flexible cable and clamp has been named a "skeet" switch, the word "skeet" being thought to suggest the sound made by the cable in moving over the pulleys.

CITING ACCIDENTS TO TEACH LESSONS

Company Issues Warnings to Workmen and Operators, Pointing Out Lessons to Be Learned from Recent Occurrences

By listing the causes of recent accidents the Consumers' Power Company of Jackson, Mich., is guarding against the occurrence of others of the same nature. Some of the accidents and the means advocated to prevent them are as follows:

Water-plant operators should exercise care when piping the governor pump. In one of the plants an operator had a painful accident when his thumb was caught between the oil cup and the disk.

Linemen need to guard against cutting themselves with draw knives while shaving poles. Several accidents have occurred due to spurs cutting out.

Linemen in changing position on poles should watch themselves very closely as they are liable to get next to "hot wires."

An operator splashed acid in his eye because he did not exercise care in reading the hydrometer while testing the storage battery.

Operators should wait until machines stop after sanding or grinding commutators before wiping them. An accident occurred due to the wiping rag catching under the brush arm and drawing the operator's hand in between it and the commutator.

When working around hot steam pipes sleeves should not be rolled up. If possible, gauntlet gloves should be worn to prevent burning of the hands and arms.

Operators should not make it a practice to close the circuit breaker and at the same time reach for the knife switch with the other hand. An accident occurred at one of the substations where the operator came in contact with the rotary switch. In the stations where negative and positive knife switches are located side by side on he same panel, extreme care should be exercised by the operator to see that he does not get across these switches and that the wires, etc., are not shorted. In either case a dead short circuit will be thrown on the rotary with a possibility of severe injury.

Manhole covers, etc., should always be put in place carefully. Severe accidents occur due to stepping on misplaced covers which tilt and throw those stepping on them.

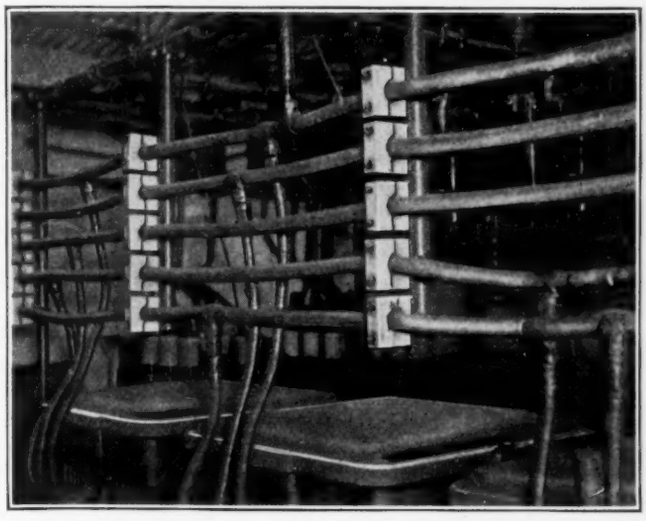
One of the other cases cited by the company calls attention to a salutary precaution easily taken but often ignored owing to the spirit of "taking a chance." It is thus stated:

A serious accident occurred that might have resulted in a fatality when an operator telephoned during a lightning storm and did not stand on the insulated platform or stool provided for the purpose. During storms do not use the telephone unless called or unless important information is to be transmitted. In any case exercise the utmost precautions and do not fail to use the insulated stool which is provided.

WEATHERPROOF CABLES USED FOR LOW-TENSION BUSES

Leads Joined to Them by Connectors Which Permit Changing Circuits Without Use of Disconnecting Switches

By the use of weatherproof cables and Dossert connectors installed in the manner pictured one company has been able to reduce considerably the cost of its low-tension buses. Disconnecting knife switches are not needed as a transformer can be cleared from its low-tension bus or connected to another with little effort in case of accident. The low-tension buses, which are five in number, are hung



LOW-TENSION BUSES ARE FLEXIBLE AND ARE HUNG DIRECTLY OVER TRANSFORMERS

directly over the transformers by means of pipes attached to the ceiling and by porcelain clamps. Only a small amount of copper is needed for the leads from the buses to the transformers.

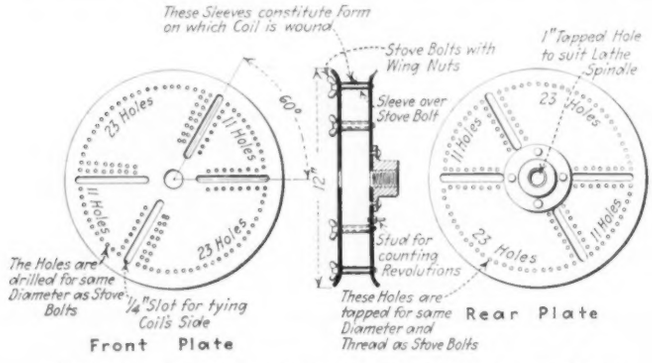
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

CHUCK FOR WINDING COILS IN SMALL SPEED LATHE

Convenient Arrangement by Which Old Armature Coils Can Be Duplicated in a Variety of Sizes

In order that coils of all sizes and shapes taken from a burned-out motor winding can be accurately duplicated, the winding plates shown in the accompanying illustration have been devised by J. M. Barber, who has charge


These Sleeves constitute Form on which Coil is wound
Stove Bolts with Wing Nuts
1" Tapped Hole to suit Lathe Spindle
Sleeve over Stove Bolt
60°
23 Holes
11 Holes
Stud for counting Revolutions
The Holes are drilled for same Diameter as Stove Bolts
¼" Slot for tying Coil's Side
These Holes are tapped for same Diameter and Thread as Stove Bolts
Front Plate
Rear Plate

ADJUSTABLE FORM FOR WINDING COILS OF VARIOUS SHAPES

of the repair shop of the Piedmont Electric Company, Asheville, N. C.

This winding chuck is made up of two iron plates 3/16 in. (4.8 mm.) thick and 12 in. (30 cm.) in diameter. To the center of the back plate is bolted a hub with a 1-in. (2.5-cm.) hole threaded for mounting on the spindle of a small speed lathe. The front plate is a duplicate of the back plate and is held to the latter by the bolts that are used to provide a frame on which the new coil is to be wound. In drilling the holes in these plates they were securely clamped together and the front plate was drilled with a 7/32-in. (5.6-mm.) drill. After passing through the front plate the location of the hole was only spotted on the back plate. The front plate was then removed and the back plate drilled as an exact duplicate according to the spots with a 5/32-in. (4-mm.) drill. These holes were then tapped with a No. 10 tap with twenty-four threads per inch. This made it possible to screw ordinary stove bolts in the back plate to make up the form for winding a new coil. Since many coils are usually wound on the same form, it was found advisable to use threaded bolts in the back plate, as these bolts support the front plate, which must be removed on the completion of each coil, and also to make a rigid form for winding the coil. Six stove bolts 1½ in. (3.7 cm.) long with sleeves made from ⅛-in. (3.1-cm.) pipe are used at the points of an old coil in making up the form for winding new ones. Thumb nuts on these bolts make it easy to clamp on the front plate. As shown in the accompanying illustration, the edges of the plates are curved outward to prevent cutting the insulation of the wire when winding the coil.

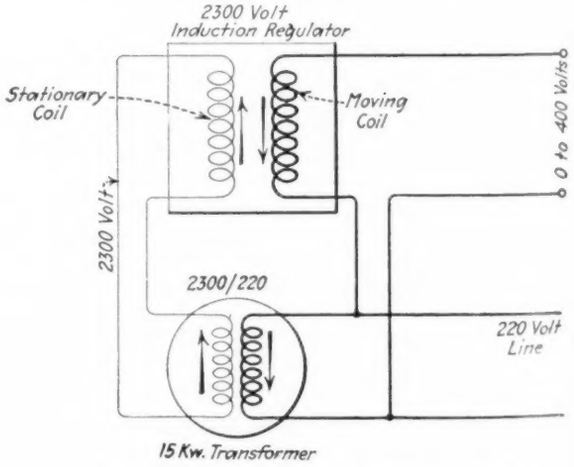
For counting the numbers of turns of an old coil used in laying out the form for a new one the back disk is provided with a stud that operates a small revolution counter mounted on the head of the lathe. This device has been found convenient for winding field coils as well as armature coils of direct-current and alternating-current motors.

TESTING VOLTAGE VARIED BY MEANS OF REGULATOR

100 Amp. Can Be Obtained at Voltages Ranging from Zero to 440 by Connecting Old Regulator with 15-Kw. Transformer

For obtaining a current as high as 100 amp. at a voltage which may be increased gradually from zero to 440, the testing department of the Sanitary District of Chicago has utilized an old commercial regulator in conjunction with a 15-kw. transformer. This improvised apparatus is useful for many purposes, such as for making impedance tests, or for heating an armature or other winding by passing current through it in order to dry it.

As shown in the diagram, the low-voltage side of the transformer is connected to a 220-volt line. The 2300-



VOLTAGE CAN BE VARIED FROM 0 TO 440

volt side of the transformer is connected to the stationary coil of the regulator, which induces a voltage of zero to 220 volts in the movable coil of the regulator, depending on its position. The voltage at the terminal posts is the sum of the line voltage and the regulator voltage. The regulator voltage may be either positive or negative with

reference to the line voltage, depending on the position of the coils. Added vectorially the two voltages allow a range of from zero to 440 volts.

DETERMINING FUSE SIZE FOR MERCURY-ARC RECTIFIER

Formula for Calculating Rating That Will Allow Starting Rectifier Without Subjecting It to Heavy Overloads

On account of the high starting current required by mercury-arc rectifiers some trouble is sometimes experienced in determining the correct size of fuse to use. If the rating is too high, the tube will not be adequately protected against overloads and its life will consequently be shortened. On the other hand, if the fuse is rated too low, there will be a tendency to blow if the tube is cold and requires a greater amount of current.

The author has found that if the fuse is rated at the value obtained by the use of the following formula proper protection will be had: $I = (1.5 \times W) \div E \times \% \times$ P. F., where I = ampere rating of fuse, W = direct-current output of rectifier in watts, % = rectifier efficiency expressed as a decimal, P. F. = power factor of outfit, and E = the voltage of the alternating-current energy.

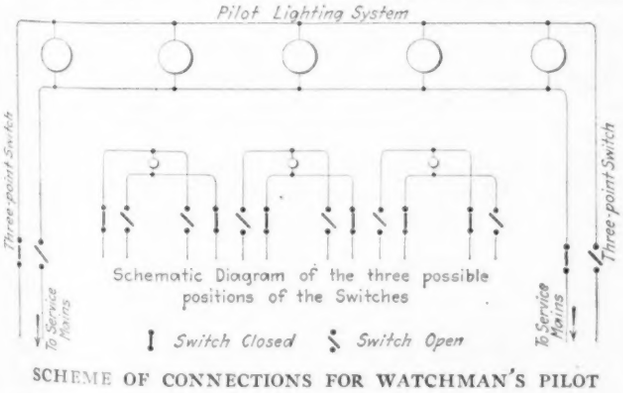
The rectifier efficiency is usually between 0.40 and 0.50 and the power factor is 0.90 in most cases. Where high reactance is used to smooth out pulsations, however, the power factor will be about 0.75.

Chicago, Ill. H. E. WEIGHTMAN.

ECONOMICAL INSTALLATION OF WATCHMAN'S PILOT LAMPS

Considerable Wiring Is Saved by Utilizing Mains at Each End of Building for Serving Two-Way Control of System

By the utilization of service mains serving the emergency stair-lighting systems at both ends of a 500-ft. (150-m.) six-story building, a saving was made of 3000 ft. (900 m.) of wire and the expense of installing this



SCHEME OF CONNECTIONS FOR WATCHMAN'S PILOT LAMP CIRCUIT

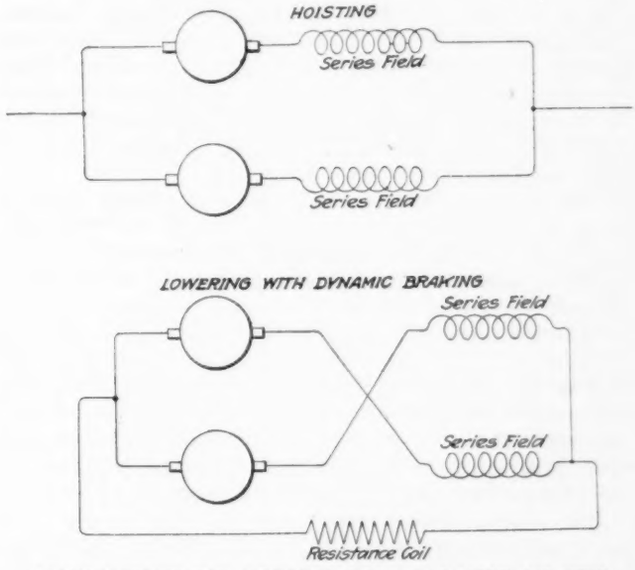
wire was avoided. The lighting system had to be designed so that the watchman could switch the lamps on when he started to inspect the floor and so that he could switch them off when he reached the opposite end. Ordinarily this type of installation requires three conductors running between switches, but because of the double service mains only two were needed and the wiring was thus saved.

The connections of the system are shown here, illustrating the four possible positions of the switches. A three-point switch is used at both ends of the system, as indicated in the diagram.

MAINTAINING A BALANCED LOAD ON D.-C. HOIST MOTORS

Cross-Connection of Armatures and Fields of Mechanically Connected Motors Keeps Load Division Equal

Two direct-current series motors mechanically connected together do not always tend to divide the load equally when used as hoist motors on ore bridges and ladle cranes equipped with dynamic braking. When act-



CONNECTIONS FOR KEEPING LOAD BALANCE ON TWO SERIES HOIST MOTORS MECHANICALLY CONNECTED

ing purely as motors the characteristics are such that the machines tend to divide the load equally during hoisting, because in case one of the motors is taking less load than the other it will tend to speed up and thus take the proper share of the load.

During dynamic braking when the machines act as generators, however, the conditions are different because in that case the characteristics are opposite to those of the motor.

If during dynamic braking one of the motors takes the greater part of the load, it will tend to slow down and take a still greater part of the load. However, the load can be balanced on motors operating under such conditions by cross-connecting the fields and armatures of the two motors. Therefore, by operating the two machines as straight series motors in parallel for hoisting and then connecting the field of one motor in series with the armature of the other for lowering, a balance of load can be obtained between the two motors for both hoisting and lowering.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

WIRING COMMITTEE OF THE N. E. L. A. DOES GOOD WORK

Comprehensive System of Testing Portable Cords Put Into Effect—Progress Toward Adoption of Universal Appliance Plug

When a low-grade portable cord comes on the market, or when one of the good old brands falls off in quality, it is usually left for the ultimate user to find out the trouble. The wiring committee of the Commercial Section of the National Electric Light Association, which met in Chicago recently, thought that central stations, contractors and dealers could and should determine the quality of portable cord before it gets to the public. After discussing the subject very fully the committee authorized its chairman, R. S. Hale of the Edison Electric Illuminating Company, Boston, to arrange for a series of physical tests on different brands of cord.

No. 16 stranded cord, which is large enough for flatirons, will probably be tested first. Those manufacturers who wish to have their cord tested by the committees may submit a sample with a detailed specification to the chairman of the committee.

Selected central-station men and contractors who are familiar with the performance of cord in actual service will be invited to rank the samples submitted. The average weight given each cord will then be computed and the result shown to other central-station men to see how their experience compares with the average judgment of the selected list who first passed judgment.

The chairman was instructed to have the sample cords put through some physical tests by a laboratory while the cords are being rated in this manner. Among the tests suggested at the meeting were: (1) tensile strength; (2) bending; (3) heating under overload; (4) bending after heating; (5) rubbing; (6) pounding.

It is hoped that the results of these tests will corroborate the rating given the cords by the appliance dealers, so that any new cord coming on the market can be appropriately rated and if any particular brand falls off in quality the deterioration will be revealed by test and not by customers' complaints.

Good progress was made toward the adoption of a universal plug to fit all appliances.

Samples of all the different types of wiring used in this country and abroad are to be placed on exhibition at the National Electric Light Association headquarters in New York. The first exhibit is a board on which are mounted all the types of wiring used in Chicago. This was presented to the committee by the Commonwealth Edison Company. Other exhibits will be added as soon as possible.

W. M. Ellis of the Building Managers' Association pointed out the desirability of being able to make extensions and changes in the wiring of office and other similar buildings without cutting into the fireproofing or going to a prohibitive extent. He strongly recommended the use of lead-covered wire in safe conditions.

C. W. Abbott and S. Blumenthal were appointed a sub-committee to collect data on improvements in wiring methods. This information will be printed in the annual report of the committee.

NEW AND SELDOM USED LIGHTING APPLICATIONS

Possibilities of Increasing Lighting Business—Good Policy for Company to Enter Into All Entertainments in Community

A merchant in a large city sold more goods by showing them in a window which was artificially illuminated during the day than by advertising the goods in the daily press. This was one of the opportunities for extending lighting business through new applications that were mentioned by R. M. Searle, vice-president of the Rochester (N. Y.) Railway & Light Company, in his address before the thirteenth annual convention of the Illuminating Engineering Society at Chicago. It was brought out in the discussion that daytime illumination of windows requires about five times normal intensities and very often special means of ventilation are necessary.

The Rochester company finds it very desirable to support all local entertainments and amusements. Light is used at the show during the many rehearsals and in the homes of all the participants. Other lighting applications which might be advantageously developed include the lighting of country roads, side streets in towns and cities, stairways, fire escapes, railroad freight classification and loading yards, monuments, outdoor sports and street dancing.

THE MANAGER'S VIEWPOINT ON HIGHER POWER RATES

Power Business Is Not a Monopoly, and Earnings from Power Business Should Not Be Limited as Are Lighting Earnings

BY T. O. KENNEDY*

Every central-station man is inclined to shy at the prospect of increasing rates. Public policy, he says, demands that rates be only high enough to allow a fair return. To this in general the writer will agree, but it is his contention that the wisest public policy is to keep power rates as high as possible, thus increasing the return from this class of business, affecting only a relatively small number of individuals, and allowing the central

* From a paper read before the Glenwood Springs meeting of the Colorado Electric Light, Power and Railway Association, 1919.

station to favor the vast majority of its consumers in the matter of lighting rates.

Furthermore, the same arguments as to fair return do not apply to both power and lighting business. The accepted reasons why a central-station company should only be allowed to earn 7 per cent or 8 per cent on its investment, while a manufacturing plant's earnings are limited only by the efficiency of its management, are that the central station enjoys a monopoly and a gross income that is practically stable and devoid of risk. These reasons apply only to the lighting business. As a matter of fact, the sale of power is no monopoly, and whenever a central station contracts to supply a power consumer its business, in so far as the capacity that it ties up for that customer is concerned, becomes just as unstable and subject to the same risks as the business of the power consumer it has contracted with. It is true that the central station has some advantage in the fact that the risk is reduced by the diversity factor due to the various lines of business for which it supplies power, but there is absolutely no justification for trying to restrict the central station to a minimum return on power business.

Another question that frequently arises in regard to power rates is: When is it advisable to put into effect a lower rate in order to secure additional business? Assuming that the additional business cannot be secured at existing rates—an assumption which is, by the way, very often made too hastily—this question is usually answered by considering only the profit on the new business under consideration. It must not be lost sight of that a lower rate once established must sooner or later be applied to all similar business already secured, and in many cases new business that is secured by reducing rates proves unprofitable to the company even though it is sold above actual cost.

Probably the most generally used form of rate for power purposes is the "two-charge" rate, consisting of a demand charge based upon the customers' demand plus an energy charge. Properly applied this is perhaps the most practical form of rate, but it has been the writer's observation that the demand charge may be a source of considerable abuse on the part of the power salesman and of actual loss to the company.

Although elaborate arrangements, including testing and reading of watt-hour meters, are made to determine the energy consumption, few companies have any established practice for determining customers' demands or for supervising the growth of such demands after the original installation has been made. It has frequently happened that a power consumer's demand has so greatly increased during the life of a contract that it has been necessary to double or treble the capacity of the transformer installation supplying him and yet no increase has been made on the consumer's ledger in the demand for which he is paying. The writer recalls one instance where, upon checking up the demand and monthly consumption of a power consumer as shown on the books, the load factor was almost 200 per cent. A test showed that this customer was paying for only one-third of his actual demand. The revenue that had been lost in this one instance would have paid for enough demand meters to equip every power customer on the company's lines.

During the past few years, when fuel prices have been increased by leaps and bounds, some central station companies have been including a "coal clause" in their larger power contracts, whereby the rate is automatically increased by advances in fuel costs. Inasmuch as practically all companies are now subject to either state or municipal regulation and have published schedules setting forth uniform rates, it seems to the writer that a more satisfactory way in which to handle this matter of indefinite production costs is to use a standard form of contract in which the rate is referred to only by schedule number and is not specified as to amount. On this basis, it is then only requisite to file new rates when necessary owing to change in production costs, and the last rate filed always applies to all contracts then in effect.

RATES SHOULD BE BASED ON FUTURE, NOT PAST, COST

Past Cost of Rendering the Service Is Only One of the Pieces of Evidence as to What the Future Cost Will Be

BY "KASSANDRA"

There is never any question that a utility should be entitled to charge enough to cover its costs of operation and to earn a reasonable return on the value of the property devoted to public use.

There are, however, many questions as to how these costs and values should be computed, and the principle that is neglected in determining costs and values may be stated as follows:

The costs that should determine rates are not what it did cost in the past. The costs which should determine rates are what it would cost in the future.

The actual amounts of money that were expended in the past are often the only evidence, and are usually the best evidence, of what it would cost in the future; but these amounts are only evidence and are not of themselves a final proof.

Let us take a number of examples. A company makes unwise or unnecessary expenditures, as, for instance, when it pays too high salaries to the managers, who may or may not be stockholders. When a commission disallows these expenditures it is basing the decision, not on what it did cost, but on what it would cost under normal conditions. Again, if a company is unusually skillful or efficient, the commission may allow a higher rate of return than it allows to companies less skillfully managed. The commission is not considering the actual past cost, but it is basing its decision on what would be the costs under normal or average conditions.

Take another example. Two ordinary companies buy land for their factories. In one case a normal price is paid, but quicksand is discovered, involving a heavy piling expense. In another case a low price is paid, because of quicksand, and a high piling cost is expected, but the land turns out solid. It is obvious that if the two factories when completed are duplicates of each other the values are the same irrespective of the costs. Why should not the same principle apply to the value of generating stations?

Supposing a company buys copper at 15 cents and again at 30 cents. The values when the copper is in the transmission lines are the same, and if instead of being one company owning two lines it is two separate companies, does this change the value? The only answer is

that value depends on what it would cost for something equally good, or on the probable future cost rather than the actual past cost.

It should be clear that since the past cost does *not* and cannot tell the present value, therefore it is the future cost—*i.e.*, the amount it would cost in the future—that determines the present value, or what a wise purchaser would be willing to pay.

Many more instances can be given, but they are unnecessary to prove that the past cost has no relation to the present or future value except as one of the pieces of evidence as to what the future cost would be. Let us look at some of the results of this principle.

In the first place, it renders unnecessary meticulous appraisals and extensive scrutiny of details that are involved in many rate cases of to-day.

In the second case, it will have a tremendous effect as an incentive to economy and efficiency, because a manager or owner will be judged solely by results, since he will have to realize that if he wastes money in building or operation he will not be allowed to raise the rates to recoup himself or his stockholders, while if he saves money as compared with the normal skill and efficiency his company will be allowed the whole of it and will not be punished for his skill by being obliged to divide the savings with those who did not help in making them. It may (and probably will) be said that this principle would mean that a utility could make rates to-day sufficient to pay a return on what its plant would cost to replace at present prices.

If these dangers were real, they would be even worse under the principle of past costs. If past costs were forever to determine rates, then the fact that past costs have differed from year to year would make the rate for service different from different generating stations, according to the date when the station from which the energy came was built. The idea of averaging a lot of costs, as, for instance, averaging the costs over a period of years or taking the average cost of generation in several stations which pump into one system, is an attempt to get away from the trouble; but averaging solves the problem only if the average of the past cost comes out at what the cost would be in the future.

Again, if the principle should be taken to mean that a company should be entitled to earn a return on a value computed from past prices of its plant instead of the future prices, this would result in rates staying up even though in competition with plants in other cities built at lower prices.

The answer to both these contentions is that we are considering the whole service and not separate parts. Values and rates should depend not on the past costs but on the probable future costs of the whole service, and the whole means that we cannot, or rather should not, consider one year separately from another and should not consider the parts as independent of the whole. We consider the whole future and not each year or month by itself, since when we speak of 8 per cent per annum we do not mean 8 per cent each and every year any more than we mean 8/365 per cent each and every day.

Further, we must remember that in the case of costs or values the whole is not necesarily equal to the sum of all the parts. A plot of land worth $10,000 as a whole may be worth $15,000 when divided into house lots, or, vice versa, a number of house lots the sum of whose value as house lots is $12,000 may be worth $20,000 when put together to be a site for a railroad station. We must consider the whole as having a different value from the sum of the parts, and we should consider the whole future and not each part of the future separately. The fact that we consider the whole future forbids us to compute rates solely by the prices of any particular day or month or year and thus disposes of the idea that rates based on probable future costs will vary up or down any more than rates based on past costs.

To-day costs are very high if measured by the bids of contractors for immediate delivery of small lots, but is it so sure that these measure the probable future costs or values? It would cost at to-day's prices say $50 a spindle to put up a cotton mill and start it as a going concern, but we can buy going concerns in the stock or other markets at a much less price. In the same way there have been times when contractors would offer to build a new plant at much less than people were actually paying in the market for existing plants. In making rates it is the costs and values of the whole future, and not of the next few months, that must be considered.

The problem in each case is to determine what would or will be the future costs under normal management and normal skill, with allowance for a normal amount of mistakes. The experience of a particular company in the past furnishes evidence, and usually good evidence, as to what these costs should be in the future; but the past experience does not furnish conclusive evidence as to the future. Neither is an optimistic estimate of the future made by some adversary of the company to be considered as conclusive evidence. The commission should consider all the evidence and should determine what future rates will pay the probable future costs, including a fair return on a fair value (not necessarily cost) of the property, taking into account any value it may have as a whole over and above the value of its separate parts if divided. These estimates of the future costs should be based neither on unusually good nor on unusually bad management, but on what is to be normally expected.

This principle is already recognized by the commissions in many cases. If, however, it were still more clearly recognized, there would be a great saving in labor of appraisement and of accounting. Meticulous appraisal and meticulous investigation into past expenses is not worth while unless the past expenses are to be considered as conclusive proof of the future, and it should be clear that they are not proof but at best only evidence.

If we would all recognize that it is the future, and not the past, that is under discussion, the future progress would be much better for both the utilities and their customers. The past, of course, must be recognized to some extent. If we are going to get advantage from good management, the commissions must recognize that honest mistakes of judgment in the past must not be too severely penalized, but that companies which have made mistakes in good faith must be allowed a chance to make up for them, and, vice versa, unusually high skill or luck should not claim its pound of flesh unless it is prepared to pay for every drop of blood on the future occasions when it is not so fortunate.

The point I want to bring out is that it is the future costs and future rates that are the most important items and that the past should be considered only as evidence of what will happen in the future.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Electric Projectors of Large Caliber in War Time.—MARIUS GROSJEAN.—A résumé of the progress made during the war in the manufacture of large-caliber searchlamps for defense against airships, including descriptions and details of construction hitherto little known.—*Revue Générale de l'Electricité,* Oct. 4, 1919.

Development of the Chicago Street-Lighting System.—WILLIAM G. KEITH.—The writer considers the installation of metallic-flame lamps and also the series incandescent gas-filled lamps for lighting the streets in Chicago. Data are given on the cost and characteristics of these systems.—*Electrical Review,* Oct. 4, 1919.

Searchlight Testing.—F. A. BENFORD.—The author states that the chief characteristics required of anti-aircraft searchlights are mobility, reliability, ability to operate at any position, good luminous efficiency and quietness of operation. The test described may be put under three main headings: First, mechanical or operation test of the searchlamp or carbons; second, a test of the relative revealing power of the searchlights; third, a photometric analysis of the beams of light. The third class is the one which required the greatest effort and is described in detail in this article. Suitable ground for these tests was found in the neighborhood of Schenectady. The power station and searchlamp were located on a hillside having a free view across the wide shallow valley. A high point of ground 2300 ft. (700 m.) away was selected for the station at which photometric readings were taken. A mile and a half (2.4 km.) away an airplane

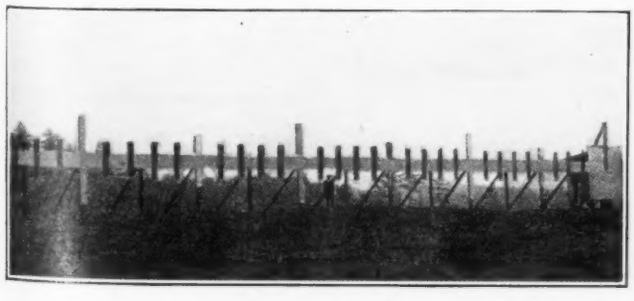


FIG. 1—CLOSE-UP VIEW OF THE BEAM SCALE AND PHOTOMETER HOUSE.

silhouette was erected, and three miles across the valley was the big "vanishing" target mounted on the brow of a hill so that the sky formed the background. At least five men, with some means of communication between the different stations, were required, namely, a lamp operator, beam trainer, communication man, photometric reader and data recorder. A scale was set up at the photometer house, as shown in Fig. 1, for the purpose of obtaining the distribution of candlepower across the beam, which was trained upon the photometer house and scale. The points of measurement were usually 0.2 deg. apart, or two small divisions on the scale. The beam was then moved across the photometer house and positions were determined by means of the edges of the beams on the scale. In general the testing was done across the hori-

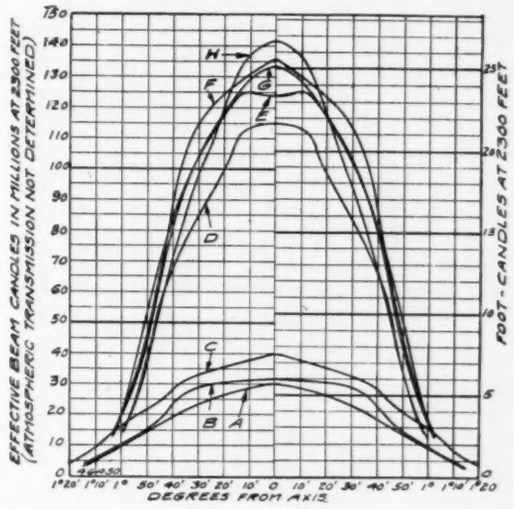


FIG. 2—CURVES SHOWING THE GREAT IMPROVEMENT IN EFFICIENCY REALIZED THROUGH THE USE OF BETTER DESIGNED AND MADE ELECTRODES

zontal center line of the beam, but a vertical scale was built, so that occasional special tests in a vertical plane could be carried out. The photometers were of the Weber portable type with a working range of 100,000 to 1, which is more than sufficient to cover the variations in intensity encountered. The readings were in foot-candles at the face of the target, normal illumination, and the apparent intensity of the searchlight in candles was found by multiplying the illumination by the square of the distance, or 5,290,000. It was found necessary to divide the scheme for determining the loss of candlepower due to the absorption of light between the searchlamp and the target. Fig. 2 shows the characteristics of eight different searchlamps, those marked *a, b* and *c* being of older design and the others of modern construction. It is evident, then, what progress was made during the war in the production of powerful searchlamps.—*General Electric Review,* September, 1919.

Generation, Transmission and Distribution

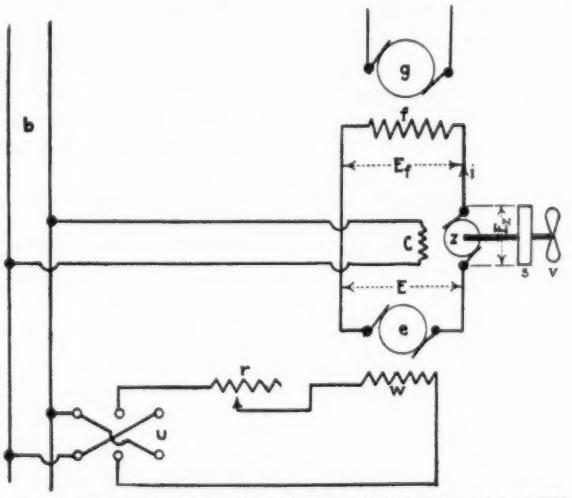
Boiler Insulation Practice in Oil-Burning Steam Plants.—A. L. GOSSMAN.—An interesting discussion of the heat-insulating properties of materials used in boiler construction. The writer gives some temperature gradient curves showing the temperature distribution through a boiler wall made up of different materials.—*Journal of Electricity,* Oct. 15, 1919.

Effect of Ohmic Resistance on Surges.—R. Hiecke.—A timely mathematical article of considerable length in which the author investigates the effect of protective resistance in oil switches. He concludes that a considerable protective effect may be attributed to resistance of the valves usually employed.—*Science Abstracts, Section B,* Sept. 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau,* March 30 and April 6, 1919.)

Methods of Increasing Capacity of Existing Transmission Lines.—In this paper the author showed how the need for increased capacity of distribution lines and network brought about by a rapid growth of the central-station power load can best be met under different conditions. In general, power distribution systems are carrying, at the original voltage for which they were designed, much greater loads than they were originally designed for. Their capacity can be best increased by increasing the voltage from the point of view both of the cost and of the quality of service as measured by voltage regulation. If the existing voltage is 2300, an increase to 4000 can generally be made very readily and in almost every case will be found desirable. This means that an increase in capacity of 73 per cent can be obtained with little or no new equipment and at very low costs. In some cases a greater increase in voltage will be desirable, in which case the reinsulation of lines and new transformers will be required.—*Electrical Review,* Oct. 4, 1919.

Voltage Drop in Lines Fed by Asynchronous Generators.—C. Palestrino.—Owing to the considerable demand for energy on the part of war manufacturers in Italy, it was necessary fully to utilize the power that the electric central stations were able to furnish and therefore to connect them in such a manner as to help one another. So it happened that the working of groups constituted by asynchronous motors and synchronous alternators, generally used to convert the frequency of the current supplying the motor into a different frequency, was inverted, so that the asynchronous motors were working as asynchronous alternators. The author was able to observe that in all cases the voltage drop in the line was larger when the asynchronous machine acted as a motor than when it acted as a generator. In one case the voltage drop for a line current of 200 amp. was 360 volts in the former condition and 140 volts in the latter. In another case, the normal pressure being 3000 volts, the pressure at the asynchronous motor was 2680 volts for 200 amp. in the line, while it was 3050 volts (*i.e.,* the voltage drop was negative) when the machine worked as an asynchronous generator, the current in the line always being 200 amp. The reason for the different behavior of the machine when acting as a motor or as a generator consists in the fact that the magnetizing current being always furnished by the synchronous alternator produces a voltage drop in the line constant in sign and value, whatever the conditions of working. Since, however, the sign of the active current changes with said conditions, the voltage drop also changes sign when these conditions change. So that in the first case the voltage drop in the line is the sum of the two, while in the second case it is the difference of the two and can therefore become negative. The difference between the two cases increases with the capacity of the line and with the working pressure, because of the importance of the capacity phenomena in this case; in the case of cable lines the phenomenon is particularly striking.—*Science Abstracts, Section B,* Sept. 30, 1919. (Abstracted from *Elettrotecnica,* July 5, 1919.)

Rapid Reversal of Field Excitation.—Referring to the illustration, the field winding f of the generator g, which is to be reversed rapidly in polarity, is excited by a machine e in series with a supplementary machine z. The latter is coupled to a flywheel and, say, a fan v. Both e and z are excited from a constant-voltage supply b. During steady operation z runs as a motor and the effective voltage across the field winding f is $Ef = (E - Ez)$. When it is desired to reverse the field current i the switch u is reversed and with it the voltage E. Until the kinetic energy of s is absorbed the machine z runs in the same



SCHEME FOR RAPID REVERSAL OF GENERATOR POLARITY

direction as before and acts as a generator so that the voltage across f is $(E - E_z)$, decreasing to E as z comes to rest, and to $(E - E_z)$ as z starts again as a motor in the opposite direction. The increased voltage on the field at the moment of reversal greatly reduces the time of reversal. In a certain case fifteen seconds was taken to reverse 5 amp. in a field winding without auxiliary equipment; eleven seconds was taken when a flywheel auxiliary was used as above. The inertia of the flywheel has a considerable influence on the time taken for reversal.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elektrot. Zeits.,* May 15, 1919.)

Installations, Systems and Appliances

Electro-Pneumatic Welding Machine.—In operating spot-welding machines of the usual type the pressure required for the weld is produced by a foot pedal. This is tiring to the operator, especially as he may have to make 15,000 welds a day. The electro-pneumatic welding machines of the Allgemeine Elektricitaets-Gesellschaft are equipped with a compressed-air cylinder controlled by a foot pedal, which requires very small effort to depress. The motion may also be regulated by a small motor that actuates the mechanism a given number of times at the required intervals. The air consumption is very small, and the pressure up to 6 atmospheres. By this device the capacity of the welding machine may be increased by 50 per cent.—*Technical Review,* Oct. 28, 1919. (Abstracted from *Mitteilungen,* March, 1919.)

Comparative Cost of Electric and Gas Heating.—A. DELAMARRE.—A computation based on the cost of producing a calory by four systems of heating, one using electricity and three gas. On the assumption that the selling price of a cubic meter of gas and a kilowatt-hour of energy are the same, the results naturally favor gas strongly. Electricity at 0.09 franc a kilowatt-hour would be equal to gas at 0.2 franc a cubic meter, the author figures; electricity at 0.13 franc to gas at 0.3 franc, and electricity at 0.17 franc to gas at 0.4 franc, and he holds that electrical heating may be so improved by a recuperative process as to allow of a practicable tariff.—*Revue Générale de l'Electricité,* July 12, 1919.

Electric Hot-Water Supply.—It is shown that electric methods of supplying hot water for industrial and commercial purposes are economical and that their use is of special importance in areas supplied by long-distance transmission. An apparatus is described that is manufactured by A. Ritterhaus of Kassel. It takes 3 kw. and is provided with a thermostat by which the current is interrupted when the water reaches a given temperature. The average daily consumption in a given year was 15.4 units, the maximum consumption on any one day 22 units, and the average number of hours of use per day about six.—*Technical Supplement, Review of Foreign Press,* Aug. 19, 1919. (Abstracted from *Elektrotechnische Zeitschrift,* June 12, 1919.)

Electrophysics and Magnetism

The Arrangement of Electrons in Atoms and Molecules.—IRVING LANGMUIR.—This is the third and concluding number of the series. The author states that his theory explains the periodic properties of all the elements, including those of the eighth group and the rare earths. It meets with success in explaining the magnetic properties of the elements and applies as well to the so-called physical properties such as boiling points, freezing points, electric conductivity, etc, as it does to chemical properties.—*General Electric Review,* October, 1919.

Special Photoelectric Sensitivity of Silver Sulphide and Several Other Substances.—W. W. COBLENTZ and H. KAHLER.—Data are given on the change in the electrical resistance of sulphide of silver and of bismuth when exposed to radiations of wave-lengths extending from 0.6*mu* to 3*mu*. Measurements were made also on galena, cylindrite, pyrites and jamesonite. The effect of temperature on the intensity of the exciting light and of mechanical working upon photoelectric sensitivity of silver sulphide was investigated.—*Scientific Paper* No. 344, U. S. Bureau of Standards, September, 1919.

Units, Measurements and Instruments

Measurement of Alternating Waves with the Braun Tube.—E. LUBKE.—A contact maker without inertia, consisting of the ionizing of the gas by means of cathode rays, is described for the purpose of delineating oscillatory curves by the Joubert method. This problem is discussed and the tracing of alternating-current waves between frequencies of 50 and 3 $\times$ 10^5 cycles per second is carried out. The delineation of oscillatory curves up to 100 m. wave length, and with greater accuracy, is possible using the special double Braun tube in which a glowing cathode and a steady voltage of 220 is used. Since the current requirements of this arrangement are exceedingly small, it lends itself to the measurement of high-frequency fields.—London *Electrician,* Sept. 12, 1919. (Abstracted from *Archiv. für Elektrotechnik,* Nos. 5 and 6, 1917.)

Measurement of Frequency.—A device has been developed by Schering and Engelhardt at the Physikalisch-Technische Reichsanstalt for the accurate measurement of frequency. A steel tuning fork, 240 mm. long and 4.6 mm. by 7.6 mm. in section, is strongly magnetized, and a coil of 1000 turns of 0.05-mm. copper wire wound on an iron core 7.6 mm. by 7.6 mm. in section is placed between the ends of the prongs of the tuning fork. When the fork is oscillating alternating currents are induced in the coil, and these are led to a vibration galvanometer tuned to the frequency of oscillation of the fork. If a weak alternating current of a frequency to be measured is then passed through the galvanometer simultaneously with the alternating current induced by the motion of the fork, the movement swings in a period corresponding to the beats produced by the superposed alternating currents, and the frequency to be determined may be calculated by the frequency of the beats. The fork can be adjusted in frequency between 40 cycles and 60 cycles by adjusting a movable weight, and a displacement of 1 mm. of this weight corresponds to an alteration in frequency of 9.24 cycles a second. Measurements can be made to an accuracy of about 0.01 per cent.—*Technical Supplement, Review of Foreign Press,* Aug. 19, 1919. (Abstracted from *Zeitschrift für Instrument.,* May, 1919.)

Telegraphy, Telephony and Signals

German Wireless Telegraphy.—A. MEISSNER.—This paper gives a résumé of the progress of wireless telegraphy in Germany during the war. The various sections deal with (1) large power stations, (2) spark stations, (3) arc transmitters, (4) vacuum-tube transmitters, (5) directive transmitters, (6) new type of coil for continuous-wave work with very small damping, (7) receivers, (8) direction finders, (9) relays, (10) antennas.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elektrot. Zeits.,* March 13, 1919.)

Resonance Frequency in Oscillatory Circuits with Parallel Resistances.—M. REITHOFFER.—A mathematical investigation of the effect of parallel resistances on the resonance wave lengths of oscillatory circuits. Various special cases are dealt with, and it is shown that for undamped oscillations there are three cases of resonance, according as maximum condenser current, inductance current or condenser voltage is considered.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Jahrb. d. Drahtl.,* April, 1917.)

Radio-Telegraphy in Competition with Wire Telegraphy in Overland Work.—ROBERT BOYD BLACK.—After considering some of the obstacles in the way of successful competition of overland radio service with wire service, the author deals with the mode of overcoming these difficulties. He recommends also radio duplex circuits, reception with loud-speaking receivers and amplifiers, trunk and way circuits from large radio centers of traffic, and relaying stations. The organization and operation of the Pacific Coast chain of duplex radio stations of the Federal Telegraph Company is then described in considerable detail.—*Proceedings Institute of Radio Engineering,* August, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

This issue of the ELECTRICAL WORLD *is the seventh that has been published at Buffalo, N. Y., owing to the troubles in the printing trades at New York City, now over, as announced previously. Publication in New York will be resumed with the first issue of the new year.*

Summarized News

Principal Happenings Up to Closing of Forms for This Issue—Printed Dec. 20

The end of the bituminous coal strike and the resignation of Fuel Administrator Garfield, who disagreed with the principle involved in the agreement arrived at, have been followed by the removal of the restrictions on soft-coal consumption that had been imposed by the Railroad Administration, and coal is now being delivered to the original consignees instead of being distributed to points of greatest need.

Important action upon the future activities of the National Electric Light Association is expected at two important meetings to be held in New York in January. The public policy committee will meet on Jan. 29 and the executive committee on Jan. 30. John A. Britton of San Francisco, chairman of the public policy committee. and President R. H. Ballard of Los Angeles will be present.

The second industrial conference, which is now meeting in Washington at the call of President Wilson, considered at one of its recent sessions the subject of relations between public utility employers and employees. Two points were discussed, whether such employees have a right to strike and what machinery should be provided to adjust their grievances. A tentative statement of the views of the conference will be drafted by a sub-committee.

Regulations enacted because of the recent fuel shortage were responsible for a lighter demand for electrical materials in the South and Middle West. In New England and the Eastern States there was no let-up in the unusually heavy demand for materials, as coal supplies here were better able to stand the strain. Along the Pacific Coast, especially around Seattle and Portland, abnormally cold weather for a few days stopped building and even several lines of business, and Christmas buying hesitated. Jobbers and retailers hoped to recoup a bit on stocks.

During this time heaters and heating-ware sales have been heavy throughout the country and stocks are low. In evidence of this one prominent manufacturer has notified his employees that he will not be able to supply them with the company's heating appliances this Christmas as his factory is six months behind on orders. Other stocks too have been hit hard. Low-voltage porcelain in the East is short, and non-metallic flexible conduit and pipe stocks in small sizes are in general low. Flexible armored conductor is especially short in the East.

Shipments are lengthening on industrial trucks and lamps in New England, and around Chicago industrial control and industrial heating apparatus are not coming through in such good time. In the South shipments in general are slower. There the demand for wire is not being met by supply, although a recent large shipment has arrived. Schedule material in the South is in fair stock, but it is expected that unless more comes in very soon there will be little left for January's needs.

A new bright spot is reported in New England, where schedule material production is said to be in better shape, and the production of sockets is nearing the point where the shortage may be relieved, if only temporarily. Lamp stocks in the West are reported better.

Prices have been holding firmly with all the shortage in materials. The past week has shown few rises in price as compared to earlier in December. Crossarms of yellow pine are higher, and from Chicago one company is no longer in the pole market because of labor shortage. This may be relieved in a couple of weeks, however, but an advance in pole prices may be expected.

At the Dec. 12 meeting of the American Welding Society in New York several of those present discussed the theory of metallic arc welding which was presented by Prof. R. G. Hudson at the previous meeting. Among them were O. H. Eschholz, C. J. Holslag and W. E. Ruder. Other authorities presented written discussions. Some of the speakers differed with Professor Hudson, saying that rapid expansion of the more volatile constituents of welding electrodes cannot account for some of the projection phenomena occurring in a welding arc.

Meeting at Hot Springs, Va., on Dec. 11, 12 and 13, the Electric Power Club heard reports from sections and committees bearing on the rearrangement of its organization which had been effected since the previous meeting. An unusual feature of the meeting was a review of some of the conditions found in Europe by James Burke, the president. Mr. Burke returned recently from his trip to London as one of the delegates of the American Institute of Electrical Engineers to the meeting of the International Electrotechnical Commission. Walter Gordon Merritt, counsel of the League for Industrial Rights, addressed the members.

Expedients in industrial plant operation are the order of the day in the Middle West. The tractor plant of the International Harvester Company and the plants of some automobile companies which have test floors for new automobile engines worked out a clever stunt. The induction motors which ordinarily drive the engine under test were reversed and were driven overspeed to supply the factory lighting. Wattless exciting current was taken from the regular central-station source, this being permissible as it did not show on the meter and could not be classed as power. Power for the factory line shaft was supplied by farm tractors belted to the individual or group shaft.

The prospects of hydroelectric power being purchased by the city of Holyoke, Mass., from the Turners Falls Power & Electric Company appear to be waning, owing to an adverse report by Samuel M. Green of Springfield, Mass., a consulting engineer called into the case a few weeks since by the city government.

The Bureau of Foreign and Domestic Commerce has drafted a questionnaire to be forwarded to its commercial agents which when filled out will give the characteristics of electricity supply in various parts of the world.

The War Department is offering for sale 400 new gasoline-driven 25-kw., 115-volt or 230-volt generator sets.

According to the Geological Survey, the production of bituminous coal during the first week of December—the fifth week of the strike—was 43.5 per cent of normal. The course of the output from week to week has been as follows: Nov. 2-8, 29.6 per cent of normal; Nov. 9-15, 33.3 per cent of normal; Nov. 16-22, 44.5 per cent of normal; Nov. 23-29, 47.3 per cent of normal; Nov. 30-Dec. 6, 43.5 per cent of normal.

Among the larger projects contemplated are extensions and improvements to the plant of the Fort Smith (Ark.) Light & Power Company, to cost about $250,000.

The Portville-Cattaraugus County Utilities Company has petitioned the Public Service Commission for authority to construct and operate an electric light and power plant in Portville, N. Y., and also for permission to issue $50,000 in bonds to cover its cost.

WATER-POWER DEVELOPMENT URGED UPON THE SENATE

Senator Jones of Washington Asks for Legislation That Will Bring About the Needed Utilization of Water Power

Senator Jones of Washington, in an address before the United States Senate on Dec. 6, pointed out the great need of water-power development. He gave a synopsis of the pending water-power bill as reported to the Senate by the finance committee.

"The necessity for the development of our water power," Senator Jones declared, "is of paramount importance to the people of the United States, and Congress should enact a law without further delay the terms of which will make the investment of capital safe and not prevent a reasonable return.

"The bill now before the Senate is perhaps too restrictive in the terms and requirements it imposes on the capital invested and upon the details of operation, but water-power men tell me they can work under it, and I trust that the Senate may pass the committee bill without in any way making its terms more onerous."

Senator Jones took up the subject of the great public interest in adequate water-power development. He said:

The utilization of even one-third of the enormous amount of energy latent but now wasting in our falling waters would make the United States the greatest manufacturing country of the world. The development of our water powers is intimately connected with the solution of such great national problems as the national defense, extension of inland waterways, shortage of food, conservation of coal, oil and labor, irrigation of arid lands, and railroad car shortage.

In addition to conserving vast quantities of coal and labor to mine and handle it, the hydroelectric energy existing in our running waters will, when developed, be utilized in the manufacture of explosives, fertilizers, wood pulp and paper, electrochemicals, copper and aluminum, and in other industrial applications. Under new electrical processes our deposits of phosphates, clays and minerals would be used to an enormous extent. The power would also be used for electrification of thousands of miles of railroads. Pumping plants driven by this cheap hydroelectric power would furnish water to reclaim fully 10,000,000 acres of now desert lands in locations where the power is now wasting and the lands useless, though their shores are washed by great rivers, and this at a time when increase of crops is so much needed to bring down cost of living and to furnish homes and employment to thousands of agricultural workers.

Over 4000 miles of the upper reaches of our streams would be opened to navigation. The cost of these river improvements would be upward of $800,000,000, and if accomplished by private capital for purposes of power production instead of through taxation would not cost the government a dollar except for the bare locks and removal of minor obstacles in those portions of the streams which are not connected with power development.

Great electrochemical manufacturing plants will be built in many different parts of the country, coincident with the development of hydroelectric energy for the manufacture of such chemicals as calcium carbide, caustic soda, bleaching powder, abrasives and electrodes, in electrolytic treatment of metals and alloys such as copper, zinc, aluminum, silicon and vanadium, and in production of acetone and atmospheric nitric acid, used in making powder and explosives.

Other countries are awake to the necessity of developing their water powers. A French corporation with $250,000,000 of capital is about to undertake the utilization of 700,000 hp. now wasting in the River Rhone, and incidentally these improvements will, through canalization, make it possible for boats to go up the Rhone to its connection with the River Rhine and thence down the Rhine. Italy, which is entirely without coal, is about to develop her water powers on an immense scale. Spain is offering liberal concessions looking to the development of her water powers now wasting in the Pyrenees and other mountain ranges. Great hydroelectric projects are about to be undertaken in the Scandinavian countries and in the nations of South America.

American bankers are being pressed by advantageous offers to finance many of these foreign water-power developments. American engineers are being employed to construct them, and American manufacturers of waterwheels and power machinery are booking orders up to their capacity for foreign shipment. If Congress delays enactment of a workable water-power law the development of the water powers of this country may have to await completion of foreign hydroelectric projects before they can be begun, because the necessary money, skilled men and machinery will have gone abroad and not be available here. Already American concerns because of lack of available water power in the United States, caused by its being impossible to develop them under present federal laws, have been forced to establish electrochemical plants in Canada, Norway and France. These expatriated plants, costing millions of dollars and employing thousands of men, have developed over 250,000 hp. in foreign countries which should have been developed in the United States of America.

Why not give those who would develop our wasting water powers the right to work, the right to build and expand and develop, the right to help create a greater and more powerful industrial nation? Why not give them a law to work under which shall encourage and not hamper their just activities—a law which, while placing them under the constant supervision of the public authorities and sufficiently safeguarding every public interest, yet shall be of such a fair and businesslike nature that under its operation men may hope for a generous return for their work and risk, and capital be assured of a safe investment? This done, they will open up deserts and make farms; they will build factories and cities, open up new reaches of inland waterways, employ labor tnd as a necessary consequence reduce the cost of living.

BUREAU OF STANDARDS ASKS APPROPRIATIONS

Government Organization Asks Congress for Larger Amounts to Carry Out Electrical and Other Work Planned

The Bureau of Standards has asked Congress to furnish nearly $3,000,000 to cover the work which it plans to carry out during the next fiscal year. This program includes several items of interest to electrical industries. They are as follows:

For investigation of the standard of practice and method of measurement of public utilities, such as electric light, electric power, water and gas, and the solution of the problems which arise in connection with standards in such service, $200,000 (an increase of $115,000 over the current appropriation).

To investigate conditions of personal hazard in electrical and industrial establishments and other places where apparatus and machinery are used or hazardous materials are handled; to formulate safety standards covering construction, installation and operation of electrical and mechanical apparatus and machinery; to prepare national safety codes suitable for general application and for adoption and enforcement by federal, state and municipal bodies, $60,000.

For electrical investigations of industrial importance, such as development of magnetic analysis of steels and magnetic alloys, magnetic testing of instruments and materials, investigation of insulating materials, study of radioactive substances, testing of electric lamps and investigation needed as a basis for specifications to cover newer types of lamps, investigations and testing of primary and secondary batteries, $50,000.

To maintain the standards and develop the methods of measuring the high-frequency electrical currents employed in radio communication, to study the properties and uses of electric waves, to investigate and standardize instruments and apparatus employed in radio communication and the materials used in their construction, to develop new applications of radio and improvements in radio systems, to co-operate in securing national and international standardization of radio nomenclature and practice, to furnish technical advice and information to radio inspectors and manufacturers of radio apparatus and other forms of electrical communication, $75,000 (an increase of $45,000).

WORCESTER, MASS., HAS LARGE ELECTRICAL SHOW

It Attracts Many Visitors and Illustrates the Good Feeling Between Different Branches of the Industry

The Worcester (Mass.) Electrical Show, which ran at Washburn Hall, Worcester, from Nov. 30 to Dec. 6 inclusive, was largely attended by central-station men, jobbing and contractor-dealer representatives from eastern New England in addition to the general public. The show was of special value as illustrating the good feeling prevailing in Worcester between the various branches of the industry and the local central station, and contractor-dealers and jobbers co-operated to the utmost to make the affair a success.

Besides the Worcester Electric Light Company, the principal exhibitors were the W. D. Kendall Electric Company, National Sales Machine Company, Libby Electric Company, Bancroft Electric Company, Coghlin Electric Company, C. C. Coghlin Electric Company, F. J. McGrail Electric Company, Westinghouse Electric & Manufacturing Company, E. W. Ham Electric Company, Delta Electric Company, Treadwell Electric Company, M. S. Wright Company, Economy Electric Company, United Electrical Supply Company of Boston, Pettingell-Andrews Company of Boston, National Lamp Works of General Electric Company and Eureka Vacuum Cleaner Company.

Several meetings of Commercial Section committees of the New England Section of the National Electric Light Association were held during the show at Worcester, as was the annual meeting of the Massachusetts State Association of the National Association of Electrical Contractors. On Dec. 3 a lecture was given on commercial matters by John A. Corcoran of the General Electric Company, Schenectady, N. Y.

DISTRIBUTION OF ENERGY FOR STREET LIGHTING

A. I. E. E. Meeting at Chicago Jan. 9 Will Discuss Series and Multiple Systems and Their Variations

A national meeting of the American Institute of Electrical Engineers has been arranged for Jan. 9, 1920, at Chicago. The general subject of this meeting is to be "electrical distribution for street-lighting purposes." There will be two sessions, afternoon and evening. The morning will be devoted to registration, getting together, and board and committee meetings of various kinds, the Western Society of Engineers' rooms in the Monadnock Building being the headquarters.

The first general session will be at 2 p. m., at which the following papers will be presented: "Series Systems of Distribution for Street Lighting," by W. P. Hurley of the Westinghouse Electric & Manufacturing Company, and "Multiple Systems of Distribution for Street Lighting," by Ward Harrison of Nela Park, General Electric Company.

At 6 p. m. there will be an informal dinner, to be held at the City Club. At 7:30 p. m. the evening session at the City Club will be opened by an address by Dr. Charles P. Steinmetz on "Constant-Potential Series Distribution for Street Lighting." After this an extensive discussion of this subject is being arranged. As a number of modifications of the old series and multiple systems of distribution have been devised recently for meeting the changed conditions brought about by the new types of street-lighting lamps, it is anticipated that this discussion will bring out much of interest.

The Chicago Section of the Illuminating Engineering Society and the Electrical Section of the Western Society of Engineers will join in this meeting. Local arrangements for this meeting are in charge of J. R. Cravath, of Fowle & Cravath, Monadnock Building, Chicago.

OHIO ASSOCIATION HOLDS SPECIAL MIDYEAR MEETING

Increased Dues of Active Members, Postponed Action on Becoming Geographic Section of N. E. L. A. and Discussed Problems

The second midyear meeting of the Ohio Electric Light Association since its organization in 1895 was held at Dayton on Dec. 3. This meeting was called to consider pressing questions of finance, coal supply, affiliation with the National Electric Light Association and a certain ruling of the state fire marshal which required the light and power companies to inspect wiring on customers' premises. What seemed to bother the members most, however, were the conditions arising out of the coal shortage.

W. W. Freeman, president of the Cincinnati company and the utility representative on the district coal committee, said that no orders had been issued from Washington to curtail the supply of electric service to customers. Dr. Garfield, up to the day preceding the meeting, had only suggested conversations which he would like to see effected. Mr. Freeman said that in his opinion the utilities had no authority to limit the use of service by customers. The function of the central stations was to co-operate with the authorities but was not to exercise the police power of the state. He assured the members that their coal requirements were receiving every consideration by the coal committee for the district and no trouble had been experienced to date. The subject was discussed further by D. L. Gaskill, Greenville, F. H. Hooper, Lima, and J. C. Martin, Columbus.

The order of the Ohio fire marshal requiring the utilities to inspect all wiring jobs was rescinded prior to the meeting, as was also the marshal's order calling for the installation of inclosed fuses and inclosed externally operated switches on customers' premises. It had been found that the fire marshal had no authority to issue either order. Discussion followed by W. A. Wolls, Columbus; D. L. Gaskill, A. MacLaughlan, Square D Company; F. W. C. Bailey, Columbus; C. P. Garman, Dayton; F. H. Golding, Canton, and O. B. Reemelin, Dayton. It was pointed out that the member companies were favorably disposed to the safety devices but objected to being ordered to inspect customers' wiring. The annual revenue from the dues of active members was increased from about $1,750 to about $5,300. This was accomplished by changing from a purely population basis to dues of one-eightieth of 1 per cent of a company's gross revenue with a graduated minimum charge based on population. Before this plan was finally adopted constructive suggestions were made by E. P. Matthews, Dayton; J. C. Martin, F. H.

Hooper, W. W. Freeman, F. W. C. Bailey, Clarence E. Allis, Wooster, and H. W. Huff, Cleveland.

The proposition of affiliating with Kentucky and West Virginia to form a geographic section of the N. E. L. A. was viewed from different angles by D. L. Gaskill, W. A. Wolls, Judge Matthews, J. C. Martin, Col. D. J. Hard, Wooster, and W. W. Freeman, but no definite action was taken in the matter at this meeting.

ELECTRICAL SUBJECTS AT MECHANICAL MEETING

Papers on Electric Furnaces, Conductivity of Insulations and Electric Arc Welding Presented Before A. S. M. E.

At least three of the papers presented before the annual meeting of the American Society of Mechanical Engineers in New York during the week of Dec. 2 were of interest to the electrical men attending the meeting. On one of the days T. S. Taylor presented a paper on "Thermal Conductivity of Insulating and Other Materials." On another day H. L. Unland, General Electric Company, talked on "Electric Arc Welding" and W. E. Moore, Pittsburgh Electric Furnace Company, presented a paper sentitled "Modern Electric Furnace Practice as Related to Foundries in Particular."

Mr. Moore, in the paper which he had prepared, discussed the various types of electric furnaces now on the market and compared their operation with that of the crucible, converter and open-hearth furnaces. For foundry work, he stated, the acid-type electric furnace is best because the reducing atmosphere makes it easy to refine the steel. In a comparison between a 2-ton converter furnace and the 3-ton acid-lined furnace it was shown in the paper that the cost of electric steel per net ton in ladle was only $21.59 as compared with $45.63 as the cost of converter steel per net ton in ladle.

H. L. Hess, Hess Steel Corporation, stated in the discussion of the paper that the data obtained from extensive experience with electric furnaces in his plant definitely and conclusively proved that electric steel was the coming steel. Among others who discussed this paper were F. V. MacMullen, J. C. Graff, H. S. Whiteman and R. K. Blanchard.

WAR DEPARTMENT STUDY OF POWER AT ARMY POSTS

Department Commanders Asked for Information as to Cost and Source of Electrical Energy or Expense of Installation

All department commanders have been requested by the War Department to supply information within thirty days as to the cost of electric power at each army post. Information is to be given showing whether electricity is generated at the post, the rated kilowatt load, hours of peak load, cost of generating power per kilowatt-hour, cost of electricity if purchased from commercial sources, and whether power is of hydroelectric source. If power is neither generated nor purchased at the post, it is asked that an estimate be made of the approximate cost of installation with the probable cost per kilowatt-hour and the consumption which could be guaranteed.

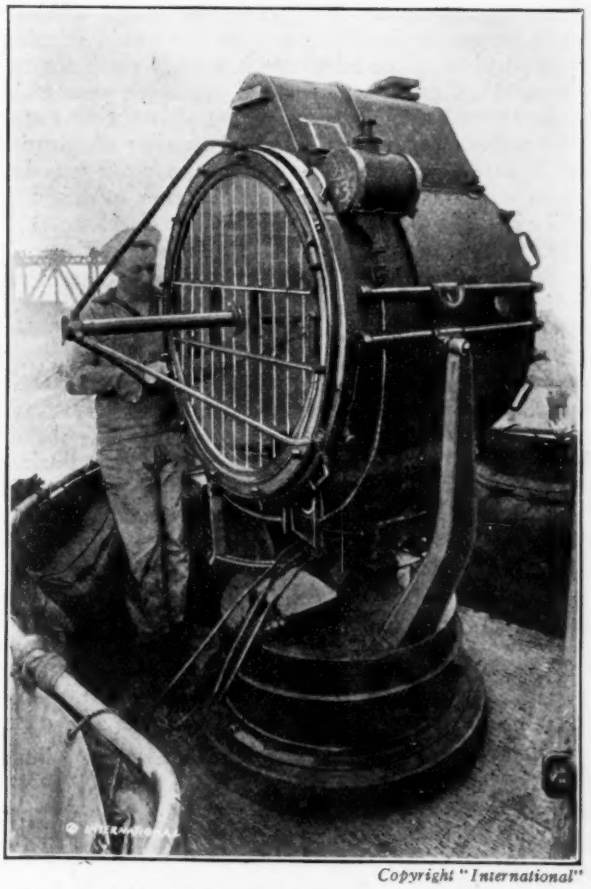
ELECTRIC POWER INCREASES THE PRODUCTION IN FRANCE

Production Is Now Greater than Before the War, and This Is Due Partly to Great Extension of Electric Power Service

Chairman Eugene Schneider of the French Mission to the United States informed the International Trade Conference at Boston on Nov. 20 that production in France is now greater than before the war, this being partly due to the great extension of electric power service. The speaker said that before the war France had 700,000 hp. in service electrically compared with 1,500,000 hp. now, and it is expected that in five years this total will be increased to 5,000,000 hp.

French workers have refused to take up with Bolshevism, believing that it would destroy their work for their country. The French workers have shown the same steadiness and spirit that they did in the trenches. M. Schneider said that since the armistice 1250 miles of railroad (to Sept. 1) had been constructed, 600 miles of canals restored, 60,000 buildings replaced and 60,000 more placed under construction, 80,000,000 cu. yd. of trenches filled and 4000 communities restored.

Searchlamp on the Pacific Fleet Flagship New Mexico



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One of the powerful searchlamps of the ship which casts a ray through miles of darkness. Seven other similar lamps are placed in the masts of the ship.

METHODS OF OBTAINING INCREASED PRODUCTION

Joint Session of Chicago Societies Discusses Decreased Labor Efficiency, Intensive Lighting and Use of Central-Station Energy

Industrial economies and increased production as effected by increasing the personal efficiency of employees, by intensive factory lighting and by use of central-station power were the subjects of papers read at a joint meeting of the Chicago sections of the American Institute of Electrical Engineers, of the American Society of Mechanical Engineers and of the Illuminating Engineering Society and the Electrical Section of the Western Society of Engineers, on Nov. 24.

Harold Almert, Chicago, stressed the importance of getting more production from labor if the prices of commodities are to come down. Among the causes of high prices he mentioned that 24,000 Scandinavians and 20,000 laborers of another nationality had emigrated in one month, and that our immigration has been reduced by 5,200,000 men since the war. He named as the main cause of high prices the inefficiency of our available labor. In order to prove his contentions he made some comparisons between work in former years and work to-day. He stated that in constructing a certain type of pole line in 1912 one pole was set in twenty-five minutes at a cost of 25 cents per hour per man; in 1914 it was set in twenty-two minutes at 50 cents per hour, and in 1919 it took forty-five minutes at 98 cents per hour. Formerly, he said, telephone installers put in five to six telephones per day, and now one telephone is a day's work for twice the pay. During the war the coal operatore were making a profit on coal at $2.35 because the plants were running at 100 per cent capacity. Thirty days after the armistice only 35 to 40 per cent of full capacity work was being done on account of the laborers taking time off when they felt like it.

Mr. Almert stated that, although many plants had increased in production in the last few years, the increase was due to improved machine efficiency and not to improved human efficiency. He said that labor's desire is not to improve but only to acquire by bargaining shorter hours, more pay and less work. As labor is therefore responsible for the high scale of costs, is it not reasonable, he inquired, to ask labor to assist in remedying the situation? Mr. Almert thought that the great majority of laborers would answer this question in the affirmative if left to themselves, but they will never do so while the radical parasites who are causing the present unrest are allowed free action.

The remedies suggested by the speaker are to weed out agitators, study human nature among employees, put the right man into the place that fits, interest him and put the spirit of progress into him. This is not an easy task, said Mr. Almert; the power to improve on mechanical efficiency is fairly common, but very uncommon is the ability for this most difficult task of increasing the efficiency of human beings.

Improved efficiency through extensive lighting was explained by actual test cases by E. D. Tillson, Chicago. He showed that a better arrangement of lights and increased intensity to 12 ft.-candles for average plants will increase production in much larger proportion than the increase in cost.

The economy of electric drive, and especially of power generated in large interconnected stations, was brought out by George H. Jones, Chicago. Electric power alone has decreased in price in late years, he stated. He pointed out the special significance at present of the low fuel consumption of the central station, which is between 2 lb. and 3 lb. per kilowatt-hour, compared with 7 lb. to 11 lb. and more of the smaller plant.

NEW RULES ON WIRING IN OHIO AND MICHIGAN

State Fire Marshal of Ohio and Chief Inspector of Electrical Division, Detroit, Require Inclosed Switches and Other Safeguards

T. Alfred Fleming, State Fire Marshal of Ohio, has issued a general order effective Oct. 15, covering any new or altered electrical equipment as follows:

Main service switches, except when mounted on a switchboard under competent supervision, must be of the inclosed safety type and installed so as to be readily accessible. All other knife switches used for connecting or disconnecting electric energy used for light, heat or power, other than switches used on switchboards or inclosed panelboards, when installed less than 7 ft. (2 m.) from the floor or elevated platforms, must be of the approved safety inclosed type, arranged to be operated from the outside of the inclosure. They shall be so marked as to indicate without opening the inclosure whether the switches are in the on or off position. They shall be constructed and installed so that fuses will be dead when the switch is opened. The switch should be designed so that it can be locked in the off position and means provided to lock or seal the inclosing case. Each switch shall have suitable arrangements for grounding and should be constructed so that it can be used on either conduit or open construction. Double-throw or alternating-current motor-starting switches designed for starting and running position must be so constructed and installed that blades of the switch will be dead when in the open position.

All automatic cut-outs located less than 7 ft. (2 m.) from the floor or elevated platforms in the vicinity of easily ignitable materials or inflammable gases must be inclosed in approved metal inclosures. These inclosures are to be readily accessible and not located in concealed places.

All alternating-current motors above 5 hp. must have approved starting devices. All direct-current motor-starting devices must be equipped with a no-voltage-release attachment. All motor-starting devices having exposed contacts must be installed and placed so that accidental contact by person or mechanical injury is reduced to a minimum.

A somewhat similar ruling has been made by Ben W. Clark, chief inspector of electrical division, department of buildings and safety engineering, Detroit. The substance of Mr. Clark's ruling, which has to do with safety switches and apartment-house wiring after Dec. 1, 1919, is as follows:

All knife switches, except on approved switchboards under constant supervision of a competent electrician, must be approved safety inclosed type, designed to be operated from outside of the inclosure and to be locked in the open position.

Safety inclosed switches must be so marked as to indicate without opening the inclosure whether switches are closed or open.

All distribution panels with switches must be approved safety design so constructed and installed that no live metal will be exposed and that the fuses, if fuses are used, will not be alive when switches are open. Except in double-throw switches for alternating-current motor starting and running, they must be so constructed and installed that the blades will not be alive when in the open position.

In double houses, duplex flats and terraces the cut-out switch and meter loop must be placed in the basement belonging to the apartment which it serves. In stores with flats above they

must be located in a public place, in the basement if possible; otherwise each store loop with cut-out and switch must be in the corresponding basement and for each flat in the corresponding kitchen. The main cut-out in these cases where conduit service is required must be installed in an approved weatherproof box on the outside of the building. The main switch, when required, must be installed inside the building according to the National Electrical Code.

All unfinished basements must be wired in rigid conduit system, and finished basements must be wired in rigid conduit or metal raceway system, and all cut-outs must be installed in approved cabinets.

LANE URGES THE USE OF OUR WATER POWERS

Secretary of Interior Outlines Again His Study of Power Possibilities in Atlantic Seaboard District

In introducing his report to the President on the administration of the Department of the Interior for the last year Secretary Franklin K. Lane remarks that he wishes to deal primarily with coal, electricity and petroleum as the three sources of light, heat and power and the need for the adoption of certain constructive polices affecting their production and distribution. He says:

It is three years since Congress was urged that we should be empowered to make a study of the power possibilities of the congested industrial part of the Atlantic seaboard, with a view to developing not only the fact that there could be effected a great saving in power and a much larger actual use secured out of that now produced, but also that new supplies could be obtained both from running water and from the conversion of coal at the mines instead of after a long rail haul.

A stream of power paralleling the Atlantic from Richmond to Boston, a main channel into which run many minor feeding streams, and from which diverge an infinite number of small delivering lines—the whole an interlocking system that would take from the coal mine and the railroad a part of their present burden and insure the operation of street lights, street cars, elevators and essential industries in the face of railroad delinquencies—this is the dream of our engineers, and a very posible dream it has seemed to me; of such value, indeed, that we might well spend a few thousand dollars in studying it, not with the thought that the government would construct or operate even the trunk line, but that it might so attract the attention of the engineering and financial world as to make it a reality.

To tie together the separated power plants of ten states so that one can give aid to the other, so that one can take the place of the other, so that all may join their power for good in any great drive that may be projected—this would be the prime purpose of the plan; and from this would evolve the development of the most practicable method of supplying this vast interdependent system with more power—perhaps from the conversion of coal, as it drops from the very tipple, using the mine as one might use a waterfall, or by the development of great hydroelectric plants on the many streams from the Androscoggin to the James.

After referring to water-power development in Germany, France and Italy, Secretary Lane points out:

With coal conditions as they are in Europe we may expect a still greater push to make use of water power to turn the industrial wheels of peace. It must be so likewise here. It is likely that the long-pending power bill which will make available the dam and reservoir sites on withdrawn public lands and make feasible the financing of many projects on both navigable and unnavigable streams will soon have become law. We shall then have an opportunity that never before has been given us to develop the hydroelectric possibilities of the country. And this raises the question as to their extent.

The theoretical maximum quantity of hydroelectric power that can be produced in the United States has recently been estimated by Dr. Steinmetz, who calculates that if every stream could be fully utilized through its length at all seasons, the power obtained would be 230,000,000 kw. (320,000,000 hp.). It is clear that only a fraction of this absolute maximum can ever be made available. The Geological Survey estimates that the water power in this country that is available for ultimate development amounts to 54,000,000 continuous horsepower.

The census of 1912 showed that the country's developed water power was 4,870,000 hp., about 9 per cent of the maximum power available for economic development and less than 2 per cent of the total that may be supplied by the streams as estimated by Dr. Steinmetz. According to the census, stationary prime movers representing a capacity of more than 30,000,000 hp., furnished by water, steam, and gas, were in operation in the United States in 1912. (This amount does not, of course, include power generated by locomotives, marine engines, automobiles and similar mobile apparatus.) The average power furnished by these stationary prime movers was probably not more than 20 per cent of their installed capacity, so that the power produced in 1912 was equivalent to probably not more than 6,000,000 continuous horsepower.

The water-power resources of the country are by no means evenly distributed. Over 70 per cent of the available water power is west of the Mississippi, whereas over 70 per cent of the total horsepower now installed in prime movers is east of the river. Therefore unless the East is to lose its industrial supremacy it must press and press hard for the development of all water-power possibilities!

Mr. Lane also enters at length into the subject of conserving coal and petroleum.

WELDING PROCESS WILL HELP TO SAVE LABOR

Dean Adams, in New Society Journal, Points Out that Further Application Is Delayed by Lack of Complete Knowledge of the Art

The first number of the *Journal* of the American Welding Society has appeared. "The movement toward the scientific advancement of welding conducted by the Emergency Fleet Corporation," it says, "and now, since necessarily dropped by the government, in the hands of the American Welding Society, has reached a stage where its proceedings should be regularly published. It is for this purpose that this journal has come into being."

In an article on "Our Prospective," President Comfort A. Adams of the society says:

"It is the simplest possible axiom, when we stop to think—and few people ever do stop to think—that the only way, in the long run, for labor as a whole to get more wealth is for it to create more wealth, and the only way to create more wealth is to increase the productivity of labor, or, to use a much abused work, to increase the efficiency of labor, which means co-operation on the one hand and the introduction of labor-saving methods on the other.

"Just here is where the American Welding Society comes in, for one of its chief functions is to increase the application of welding, which is one of the greatest labor-saving processes of the past few decades. Its predecessor, the welding committee of the Emergency Fleet Corporation, was animated in no inconsiderable degree with the spirit of co-operation, and it is the hope of the promoters of the society that this spirit will be carried over.

"The field for further application of welding is enormous, but this further application is being delayed by lack of complete knowledge of the art of welding and by the utterly confusing, and in many cases diametrically opposing, claims of competing interests. These hindrances ought to be removed, and they can be removed by the successful conduct of research work and by a cultivation of the co-operative spirit which will permit a frank, open discussion of the merits of the different processes and a reasonable agreement as to those merits."

WAR-TIME REGULATIONS ON USE OF BITUMINOUS COAL

Text of Garfield Order Restricting Consumption of Light, Power and Heat to Conserve Coal Supply

Drastic curtailment of industry was the answer of the United States Fuel Administrator to the bituminous coal strikers. By an order issued on Dec. 8 through the Railroad Administration stringent regulations were established, effective as of that date, for the conservation of light, heat and power from bituminous coal or coke.

The channel of action was that Fuel Administrator, H. A. Garfield, acting by authority of the President, issued an order giving the Railroad Administration authority to issue regulations covering the "delivery, use and consumption of coal, coke or other fuel or of power generated or produced by use or consumption of coal, coke or other fuel."

In a way the order of Dr. Garfield merely supplemented the regulations of state public service commissions and regional officials of the Railroad Administration at various points throughout the country. It, however, had the effect of making mandatory the efforts of the different public and private agencies which had been urging and trying to introduce fuel conservation measures, and it established definitely a country-wide policy for communities where soft coal is the fuel producing energy for light and power.

Although the official end of the strike and the return to work of the majority of the miners have led to the relaxation of these restrictions, particular attention will be directed to the cautionary statement of Dr. Garfield that even with the settlement of the coal strike it will take some time to adjust the country to a normal basis. This statement squares with the judgment of men in the electrical industry who believe that some time will be required to replenish the depleted stocks of coal and to restore free conditions of supply.

It is also noted that while the order of Dr. Garfield applied in the main to the use of bituminous coal or coke the Railroad Administration was apparently empowered to exercise authority with respect to other forms of fuel.

The regulations that were issued to make uniform over the country the restrictions on the consumption of bituminous coal and of light, heat and power derived therefrom were in part as follows:

Light from bituminous coal and coke:

1. No ornamental lights, white way or other unnecessary street lights, outline lighting, electric signs or illuminated billboards, show window or showcase lights are to be operated. This does not affect street lighting necessary for public safety.

2. No cabaret, dance hall, pool hall or bowling alley shall be permitted to use light except between 7 p. m. and 11 p. m.

3. Stores, including retail stores, but excepting stores selling food, and warehouses must not use light (except safety lights) except for six hours per day. Manufacturing plants shall be allowed to use light only during the time prescribed for the use of power.

Exceptions:

(a) Drug stores and restaurants may remain open according to present schedules, but must reduce lighting one-half.

(b) Railroad stations, hotels, hospitals, telephone, telegraph and newspaper offices are not included in so far as necessary lighting is concerned.

(c) General and office light must be cut off not later than 4 p. m. in office buildings, except necessary federal, state and municipal offices, and except where office operation of vital industries is involved.

(d) Dairies, refrigerator plants, bakeries, plants for the manufacture of necessary medicinal products, waterworks, sewage plants, printing plants for the printing of newspapers only, battery-charging outfits in connection with plants producing light or power for telephone, telegraph or public utility companies are exempted.

Heat from bituminous coal and coke:

1. Only enough heat may be used in offices, stores, warehouses and manufacturing plants to keep the average temperature at 68 deg. Fahr., and then only during the hours for which light is permitted. During other hours only enough heat is to be used to prevent freezing of water pipes or sprinkler systems.

2. In manufacturing plants or plants coming under power curtailment rules heat (to 68 deg. Fahr.) will be allowed only during that time prescribed for use of power.

Power from bituminous coal and coke:

1. No manufacturing plant or factory shall be furnished bituminous coal or coke or heat, light or power from bituminous coal or coke furnished by or through the United States Fuel Administration for operation in excess of three days a week on the basis of present working hours.

Exceptions:

Dairies, refrigerating plants, bakeries, plants for the manufacture of necessary food products for medicinal products, waterworks, sewage plants, printing plants for the printing of newspapers only, battery-charging outfits in connection with plants producing light or power for telephone, telegraph or public companies are exempted.

2. Elevator service must be curtailed as much as possible in accordance with above regulations on use of heat, light and power.

Electric railways:

Electric railways shall reduce schedules to minimum requirements of service under revised hours of heating, lighting and power as herein provided.

No heat shall be provided on electric cars during rush hours and heating during non-rush hours shall be curtailed as much as possible.

General:

Electric railways and manufacturing plants, stores and offices shall co-operate in arranging with the provisions of this order schedules, days and hours of work to permit the maximum utilization of transportation equipment.

NEW ENGLAND REGULATION OF COAL SUPPLY RIGOROUS

Provision Made by Committee for Distribution of Bituminous to Public Utilities When Their Supply Is Down to Ten Days

In New England the regulation of coal distribution takes into account the amount of energy generated by water power. The New England sub-committee announces that "a public utility generating power by both hydraulic plant and plant using bituminous coal will not be furnished any bituminous coal if the water power is sufficient to supply the essentials."

The committee made the following announcement:

Public utilities should immediately decide with their customers upon elimination or reduction of non-essential use of power, heat and light on the following basis:

No bituminous coal will be distributed by the Eastern regional coal committee and its sub-committees, acting for the United States Fuel Administrator, to public utilities for any except essential uses.

The Eastern regional coal committee and sub-committees will not distribute any bituminous coal to any public utility until coal supply of such public utility has been reduced to ten days and it has meanwhile restricted its distribution in accordance with the above notice.

When coal supply of public utilities has been reduced to ten day, bituminous coal as available will be distributed to them by the Eastern regional coal committee and sub-committees, upon application through the terminal railroads in the usual way, for the same percentage of their daily requirements as of their total daily kilowatt-hours generated or cubic feet of gas manufactured which is used for essential purposes as specified in regional committee's circular.

RAILROADS' FAILURE TO ANTICIPATE FUEL CRISIS

Alex Dow Points to His Experiences in Detroit, Where Efforts to Prevent a Crisis Were Nullified by Confiscation

Alex Dow, president of the Detroit Edison Company, issued a statement on Dec. 7 in which he points out the responsibility of the United States Railroad Administration in the fuel crisis now before the country. Mr. Dow says:

I and my associates have been expecting this trouble ever since April 1. We took the precaution of placing a large proportion of our coal contracts in fields that were non-union or working under local contracts. Therefore in November when we required 2100 cars of coal 1848 were actually delivered.

Our reports to-day show shipments of 141 cars, but we also have notice from the Railroad Administration that it has confiscated 130 cars. This condition has been in effect since Nov. 22, which means all our precautions have been futile.

Railroads use ordinarily about 23 per cent of all bituminous coal mined in the country. Production has been cut down since Nov. 1 to approximately 40 per cent. Take 23 per cent from 40 per cent and figure how much was left for industries and domestic uses that previously absorbed 77 per cent of this total.

It was obvious Nov. 1 that we were in for a siege. It was the duty of some person to prepare for this siege at once. Sufficient action to that end was not taken until the beginning of this month.

Another bad factor for which some one should step up and take the blame is that the railroads did not set up their usual reserve supplies this summer. They could have kept the mines operating at nearly full time if they had stocked up as they should have done in the slack period from April to July.

The idea that they could coerce the operators into selling to the railroads at less than cost seems to have possessed whoever was responsible for the purchase of railroad fuel. The result is that they are now confiscating fuel that other people were intelligent enough to have contracted for.

The enforced curtailment of industry arising from the shortage of fuel falls with far-reaching results on Detroit and on the large automobile manufacturing plants in that city, which buy most of their power from the central station.

Suggestions for Country-Wide N. E. L. A. Geographic Sections

Reporting at a recent meeting of the executive committee of the National Electric Light Association as chairman of the committee on geographic sections, R. J. McClelland stated that the committee had agreed upon a division of the country into geographic sections. He presented a map of the United States showing the proposed divisions which had the approval of Vice-President Bump.

President Ballard stated that what he had in mind for the executive committee was merely a tentative approval of the plan of dividing the country into geographic sections, and that the report of Mr. McClelland's committee might be received and published in the *Bulletin* as representing the best judgment of the committee, subject always to the desires of the people living in the existing and proposed sections. The committee would thus have an opportunity to compare with those living in the different divisions the arguments for and against large and small geographic sections. The adoption of the report along these lines would not commit any section to definite boundaries, Mr. Ballard said.

He added that in order to get an idea of the opinion of the committee's plan in different parts of the country a number of telegrams had been sent out within the last few days and enthusiastic replies had been received from men in different sections of the country.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electricity the Cheapest Good Thing.—The Duluth Edison Electric Company uses as an advertisement on its letterheads and other stationery: "Electricity, the cheapest *good* thing in Duluth."

Fuel Economy in England.—A committee of the Federation of British Industries is considering the subject of fuel economy. It is proposed to establish a department of fuel specialists, who will assist manufacturers in practical problems. A special committee, representative of all industries wishing to co-operate in the scheme, would act as an executive body. This body would deal with policy, appointment of technical staff, and confirm reports, etc., on actual fuel practice.

Extension of Patents in France.—A cablegram from Commercial Attaché Snow at Paris states that a French law of Oct. 8, published on Oct. 10, provides that patents that had not expired before Aug. 1, 1914, and patents granted or applied for between then and Aug. 1, 1919, may be prolonged up to five years, when, owing to the war, holders have been unable to exploit them normally. Article 6 provides that in case a patent is prolonged the contracts for exploitation will continue effective.

Duplex Street Lamps for Evening and Midnight.—A prospective development in the ornamental lighting field is an arrangement of two lamps in one globe, one above the other, tip to tip. The lower lamp would be 600 cp. or 1000 cp. and would burn until midnight. The upper lamp would be 100 cp. or 250 cp. and would be used during the hours when the streets are nearly deserted and when a lower intensity of light is satisfactory. The possibilities of such an improvement were outlined by A. D. Cameron and C. A. B. Halvorson at the thirteenth annual convention of the Illuminating Engineering Society. At the present time it is necessary to operate the "white way" all night or to divide the ornamental system into two circuits. This entails a reduction of half the wattage after midnight, a rather spotted appearance on the street and a wastage of light because the remaining units still light the building fronts as well as the streets. In the new units it is proposed to connect the two lamps to a small mercury cut-out placed in each unit. By momentarily reducing the current in the circuit the lower lamp would be extinguished and the upper lamp turned on. Only one circuit is required and the reduction in wattage will be 70 to 80 per cent, depending upon the sizes of lamps used. It is expected that an installation of these units will be completed by next January.

New Record in Wiring Dwellings in Minneapolis.—Indicating prosperity of the people in Minneapolis, the Northern States Power Company reports that in September one already-built house was wired for electricity every forty-five minutes during working hours. The average number of old houses wired per day during September was twenty-three, the total for the month being 597, an increase of 9 per cent over the largest house-wiring month in the experience of the company. As compared with 1918, nearly double the number of houses are being wired this fall.

Fuel Oil in New England.—Fuel oil delivered out of four stations in New England in 1918, it is estimated, replaced about 1,250,000 tons of coal, according to Perry Barker, fuel engineer, Boston, Mass., before the New London convention of the New England Section, N. E. L. A. Mr. Barker stated that this coal is equivalent to about 5,500,000 barrels of fuel oil. The oil which is coming into New England is a heavy Mexicon product, running about 16 deg. Beaumé gravity and containing about 8 lb. per gallon. It is topped for about 10 per cent of gasoline as it comes out of the wells. The use of fuel oil has certain advantages for central-station work. It is clean and can be burned at a high over-all efficiency, the stand-by losses being comparable with operating an electric range in comparison with a coal stove. When the load decreases the burners can be turned down and the oil consumption ceases. For the average type of bituminous coal furnished New England about 4¼ barrels of this Mexican oil are equivalent to one long ton of coal. The price of the oil is around $1.25 to $1.30 per barrel at the New England terminals, which corresponds to coal at $5.50

Accessory Manufacturers Admitted to Organization of Farm-Lighting Plant Manufacturers.—As the isolated electric plant manufacturers' section of the National Gas Engine Association, farm-lighting plant manufacturers voted to admit to membership manufacturers of lighting-plant accessories at a meeting in Chicago recently. The membership was divided into four groups, and all members were assessed section dues in addition to the amount of their firm membership in the national association. There will be no individual memberships. The first group is manufacturers, producers and national marketers of lighting plants. The section dues were fived at $50 for each firm. Each firm will be entitled to three votes. member company may have any employees The second group includes manufacturers who build lighting plants but turn their sale over to a specialty sales corporation and also manufacturers of one or more component parts of an individual lighting plant. These parts are recognized to be prime movers, generators, switchboards and storage batteries. Members of this group pay dues of $25 per year and are entitled to two votes. Manufacturers of accessories which are built into the lighting plant constitute the third group. The fourth group comprises manufacturers of accessories and appliances used externally to the lighting plant itself. The third and fourth groups are each limited to fifty members, who pay $10 dues and are entitled to one vote.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Seattle Section.—An address by C. Sweet on "Motor-Driven Auxiliaries on Ships" was the feature of the Oct. 21 meeting of this section of the American Institute of Electrical Engineers.

A. I. E. E., Los Angeles Section.—The Oct. 25 meeting of this section of the American Institute of Electrical Engineers took the form of an inspection trip on the U. S. S. *New Mexico*, one of the navy's electrically propelled battleships.

Electrical Co-operative League of Los Angeles.—At a recent meeting of this newly organized society A. E. Wishon, assistant general manager of the San Joaquin Light & Power Company, gave an address on "Self-Interest in Electrical Development."

Spokane Engineering and Technical Association Changes Name.—The affiliated society of engineers organized in Spokane, Wash., several years ago has changed its name from the Spokane Engineering and Technical Association to the Associated Engineers of Spokane.

New York Electrical Society.—Frank J. Sprague traced out the progress of the electric railway at the Nov. 25 meeting of the society. Mr. Sprague, who is responsible for much of the early development in this field, spoke largely from his own personal experience.

Karapetoff Addresses Western Efficiency Society.—The possibilities of acoustical engineering scientifically applied to the problems of industry were discussed on Nov. 14 by Prof. Vladimir Karapetoff, electrical engineering department of Cornell University, before the Western Efficiency Society meeting in Chicago.

Washing-Machine Manufacturers to Be Represented in N. E. L. A.—Following an address by John G. Learned, chairman of the Commercial Section, National Electric Light Association, before the American Washing Machine Manufacturers' Association, Chicago, on Nov. 19, the washing-machine manufacturers were invited to elect a representative to present their problems to the merchandise sales bureau of the N. E. L. A. Commercial Section.

Engineering Section of National Safety Council Organized.—The National Safety Council has approved the organization of an Engineering Section. The purpose of the new section is to bring together into closer contact the civil, mechanical, electrical, mining and chemical engineers in the council's membership so that they may contribute more effectively toward the solution of the purely engineering problems frequently encountered in safety work.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

COAL CLAUSE.—The Public Service Commission of Pennsylvania dismissed a complaint against a certain coal clause included in the schedule of rates of the Penn Central Light & Power Company, having declared the same to be legal in the case of the State Electric Street Railway Company vs. the Pennsylvania Utilities Company, and for the reason that the evidence did not disclose that the imposed rate was unjust or unreasonable in amount.

MAKING MUNICIPAL PLANT RATES.—The Wisconsin Railroad Commission, in granting an application of the city of Hartford to increase rates for its public utility services, held, as in similar previous cases, that taxes should be included in the costs of service by a municipal plant, in order that justice may be done between consumers and taxpayers who are in both classes and those who are in one or the other class only. Five per cent was held to be a conservative rate of interest for the city to receive in rates and revenues for the service furnished. The commission found that the schedule provided a minimum monthly charge of 50 cents for power users, regardless of motor ratings or connected load which the plant is expected to be ready at all times to carry. This was held to be clearly inequitable. The minimum bill, or preferably a definite service charge, should bear some relation to the consumer's demand rate or load, the commission declared as a governing principle.

VALUES PAID FOR PROPERTIES.—Values paid for constituent properties were discussed by the Illinois Public Utilities Commission in a decision affecting the Illinois Northern Utilities Company. The commission said in part: "There was also presented in this proceeding testimony as to the amount paid for the properties which were acquired by the Illinois Northern Utilities Company and which formed a nucleus for the present system. It appears that these transactions were consummated through the exchange of securities and cash. At the time of the purchase of the properties the purchasers had valuations prepared by a firm of consulting engineers, determined the net earnings of the property, examined the properties and their possibilities for development, and after considering all of these facts arrived at an agreement with the former owners as to the price to be paid. It does not appear that any one of these arrangements formed a conclusive determination as to the purchase price. The record indicates that the properties were purchased upon a basis of between 7 and 8 per cent return upon the purchase price without giving consideration to depreciation except as it might have been reflected through the maintenance accounts of the former owners. In most cases this reflection of depreciation in maintenance would have represented only a small proportion of the actual accruing depreciation. If large replacements had been made during the immediate preceding years, depreciation might have been more fully reflected, but it is improbable that such replacements were made, since the seller, having in mind the transfer of the property, would scarcely undertake the expenditure of large amounts to replace worn-out items of equipment. If we were to deduct depreciation at a rate of 3½ per cent considering the nature of utilities purchased, it would appear that the properties were purchased upon an earning basis of between 3½ and 4½ per cent of the purchase price. Purchases made at these figures must necessarily have given a great deal of consideration to the possibilities for future development of the property and have reflected items in very large amounts other than the physical property involved. In connection with the consideration of the weight to be given to these amounts paid by the Illinois Northern Utilities Company for its nucleus properties, we must also give some consideration to the fact that at the time of their purchase between the years 1910 and 1912 the economic status of public utilities had been thoroughly discussed. Regulatory commissions were exercising jurisdiction in the majority of the states in the Union, and through their orders and findings had expressed themselves very definitely as to the fundamental elements which should receive consideration in determining the earnings of public utilities. The purchasers of these properties were business men of reputation who were engaged in the operation of other public utilities at that time. They must have been conversant with the state of the public mind and the rulings of the courts and commissions. The petitioner introduced evidence as to the policies which had been pursued by it in the development of this property. It appears that as a result of its entry into this field many communities have received service of superior character to that previously received and many communities which previously had been without service were supplied. It is true that developments of a similar character were taking place throughout the country and that these communities had a right to expect that they would receive the opportunities which had been generally afforded elsewhere. It is likewise true that the petitioner in entering upon this project displayed initiative, and along with its desire to make money from its business, evidenced a desire to improve the service and afford the citizens of these communities the advantages which science had made possible. The rates which were in effect prior to the entry of the petitioner into this field were in general higher than those at present prevailing. This is evidenced by the rates stated in franchises which were given to the predecessor companies. These franchise rates in some cases were as high as 17 cents per kilowatt-hour and in no case were below 14½ cents per kilowatt-hour gross. These latter rates generally prevailed in those communities in which the present petitioner secured franchises subsequent to the purchase of its initial properties."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

FAILURE TO WEAR RUBBER GLOVES.—That an electric lineman killed by contact with a live wire failed to wear rubber gloves provided for him did not make him guilty of contributory negligence where the regulations did not require him to wear such gloves while doing the work upon which he was engaged when injured. (Washburn vs. Laclede Gas Light Company, 214 S. W. 410.)

POWER OF CITY TO GRANT FRANCHISES.—A special charter giving a city power to provide for lighting the streets and erecting posts for conveying electric lighting lines and to regulate the distribution of gas and other illuminative fluids empowers the city to grant a franchise to an electric light corporation to furnish electricity to the citizens. (City of Watertown vs. Watertown Light & Power Company, 173 N. W. 739.)

BANNERS STRETCHED ACROSS STREET FROM LIGHTING POLES.—Whether defendant, an incorporated town which through its mayor permitted the stretching of wires across a street between telegraph and electric light poles on either side and the placing of a banner thereon, should in the exercise of reasonable care have anticipated and guarded against the effect of the wind, whereby the poles leaned toward the street and the wires slipped down, injuring plaintiff riding on the street, was held to be a question for the jury (174 N. W. 251).

COMPANY CAN CHANGE RATES PROVIDED IT DOES NOT EXCEED THOSE STIPULATED IN THE FRANCHISE.—Under a franchise granting an electric light company the right to charge a maximum rate for electricity, or a less rate, and requiring it to furnish services under reasonable regulations to be approved by the city council, the electric light company could change its schedule of rates without consent of the city council so long as it did not exceed the prescribed maximum. (City of Watertown vs. Watertown Light & Power Company, 173 N. W. 739.)

RECOVERY ON MUNICIPAL CONTRACT.—Town whose contract with plaintiff, calling for the erection of an electric power house, was irregular, in that the motion to contract was carried by the town council by the affirmative votes of only three of the members, without the affirmative vote of the mayor, as required by code, held to have ratified the contract subsequent to its repudiation thereof, through the council, by having claimed the right to use the north wall of the structure erected as one of the walls of a pumping station, etc., so that plaintiff was entitled to claim on *quantum meruit* for the work done. (173 N. W. 93½.)

A. J. SEARS has been appointed electrical superintendent of the Mississippi River Power Company, Keokuk, Iowa.

F. J. VENNING has been appointed superintendent of operation of the Mississippi River Power Company, Keokuk, Iowa.

PROF. WILLIAM E. WICKENDEN has resigned from the faculty of the Massachusetts Institute of Technology to enter into the service of the Western Electric Company.

B. H. GARDNER has been appointed sales manager of the Connecticut Light & Power Company, Waterbury, Conn. Mr. Gardner for the past two years has been superintendent for the company in the New Britain district, prior to that having been for three years superintendent of the Norwalk district.

CHARLES F. SCRIBNER, formerly industrial engineer with the Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., and more recently consulting engineer for L. V. Estes, Incorporated, Chicago, has become associated with the Business Service Corporation of America, Chicago, in the capacity of vice-president and chief engineer.

CLIFTON R. HAYES, resident manager of the Fitchburg (Mass.) Gas & Electric Light Company and president of the New England Section of the National Electric Light Association, has been appointed engineering manager of Charles H. Tenney & Company of Boston, public utility managers and engineers. A biographical sketch of Mr. Hayes was published in the ELECTRICAL WORLD of Sept. 27, 1919. Mr. Hayes began his work at Boston on Nov. 10.

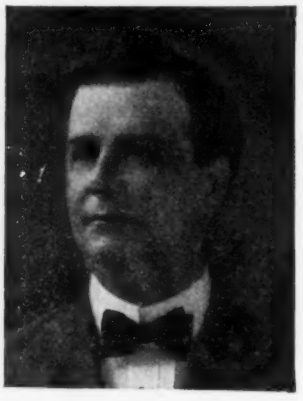
HERBERT J. FLAGG has been appointed chief engineer for the Public Service Commission of the State of Washington, with offices in Olympia. During the war he held the rank of captain in the Coast Artillery and for a considerable period he served at Fort Monroe, Va., instructing in the Coast Artillery School at that post. With the exception of his twenty-one months in the army, Mr. Flagg has been with the commission, as assistant engineer, since March 1915. He was graduated from the University of Washington in 1912. Mr. Flagg succeeds D. F. McCurrach, who resigned to enter private practice, specializing upon appraisal and rate-making lines.

CHARLES H. LEE, a recognized authority on rainfall in the High Sierra of California, has been appointed president of the California State Water Commission. He was graduated from the University of California, College of Civil Engineering, with the class of 1905. Joining the engineering staff of the vast Los Angeles Aqueduct project, he began a careful and accurate investigation of precipitation in the Sierra Nevada Mountains, the results of which have meant much to the hydroelectric industry of the West. This comprehensive survey of water resources added materially to scientific knowledge concerning the laws of precipitation and run-off in high altitudes. During the war Mr. Lee served as captain of engineers in charge of water investigations for the American Expeditionary Force in France.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

ARTHUR J. BINZ, a prominent business man of Houston, Tex., was elected Jupiter at the eighteenth annual convention of the Jovian Order in Chicago. He was graduated from St. Edwards College, Austin, Tex., with the class of 1892 and entered the electrical business in 1908 by purchasing what is now the Tel-Electric Company of Houston. He controls and is interested



ARTHUR J. BINZ

in many corporations having diversified interests, but he nevertheless expects to find time to rejuvenate the Jovian Order. Mr. Binz takes an active interest in politics.

F. H. MASTERS, who at the outbreak of war in 1914 was chief assistant editor of the *Electrician* of London, has been chosen to succeed W. R. Cooper as editor of the paper. Mr. Masters received his technical training at King's College, London, and Finsbury Technical College, under the late Prof. S. P. Thompson. He was afterward engaged in substation work on the Central London Railway, and in the electrical engineers' department of the dockyard at Chatham. He joined the *Electrician* staff in 1906, and was subsequently appointed chief assistant to the editor. During the war he was engaged on coast defense electric lighting work and on searchlights used against enemy aircraft. He contributed considerably to the development of these defenses and did very useful work in the traning of the men engaged upon them. Mr. Masters was awarded the O. B. E. and was twice mentioned in dispatches.

Obituary

THEODORE W. BLAKE, president of the Goodyear Rubber Insulating Company and of the Whitney-Blake Company, died Nov. 27 at his home in New York City at the age of fifty-three years.

ROBERT FARIES, founder and president of the Faries Manufacturing Company, Decatur, Ill., died on Nov. 17 at the age of eighty-two years. Mr. Faries was of an inventive turn of mind, and while concerned for the most part with mechanical studies, he was one of the first to develop and produce adjustable lighting fixtures. In addition to his business activities, Mr. Faries took considerable civic interest in the public affairs of Decatur. For half a century he was numbered among the industrial leaders of that city.

ALDEN R. MEEK, manager of the supply department of the New England district office of the Westinghouse Electric & Manufacturing Company at Boston, died at Harrisburg, Pa., recently, following a business trip to the Pittsburgh factory of the company. Mr. Meek was well known in the central-station trade in the Northeastern territory and was highly regarded. He was about thirty-six years of age and formerly represented the Ridgway Dynamo & Engine Company at Boston. During 1918 he was attached to the Washing (D. C.) office of the Westinghouse company.

EDGAR BARTON GREENE, former general superintendent of the Penn Central Light & Power Company, Altoona, Pa., died Nov. 25, at Ocala, Fla., where he went several years ago in the interests of his health. He was born in 1859 in Huntingdon County, Pa. He was graduated from the Bellefonte (Pa.) high school and early learned the electrical trade. In 1883 he became manager of the Edison Construction Company, Bellefonte, and in 1886 he was appointed superintendent of the Edison Electric Light Company, organized in Altoona. He was actively identified with the various electrical associations and frequently prepared papers for presentation to them. Mr. Greene was superintendent of the Penn Central Light & Power Company, Altoona district, from 1909 to 1916.

PHILIP L. SALTONSTALL, head of the banking house of Tucker, Anthony & Company, Boston, Mass., and a director in many industrial and public utility companies, died at Boston Nov. 15. Mr. Saltonstall was born at Newton, Mass., in 1867 and was educated at Harvard University. In his early business life he was connected with the Thomson-Houston Electric Company and later with the General Electric Company. He was a director of the Electric Bond & Share Company, New York; treasurer and director of the Northwestern Power Company and of the Grafton County (N. H.) Electric Light Company; treasurer, director and member of the executive committee of the Manchester (N. H.) Traction, Light & Power Company; director of the Great Northern Power Company, Duluth, Minn.; treasurer and director of the Mascoma Light & Power Company, of New Hampshire, and directtr of various electric railways.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

PLAN QUICKER TURNOVER OF CONSIGNED LAMP STOCKS

Manufacturers Hope for Co-operation Between B and A Agents in Effort to Reduce Excessive Stocks of Certain Types

It is felt by manufacturers of Mazda lamps that many A agents have not been sufficiently careful in the ordering of stocks to permit of a reasonably quick turnover. This in many cases comes back to the B agent in that he has not exercised sufficient care in the selection of his own agents. These latter at times have been chosen from walks of life so far distant from the electrical trade that their unfamiliarity with the needs of lamp consumers has been a handicap in ordering stocks. This has frequently resulted in the holding of stocks of certain types of lamps more than a year. These same lamps were understocked with other dealers. It is the equalizing of these stocks that lamp manufacturers desire, in connection with the elimination of excess stocks.

Lamp manufacturers have many million dollars' worth of stock on consignment, and plans are under way to encourage quicker turnover of stocks. One method considered would be to have the B agent keep in closer contact with his A agents and investigate their territories with a view to more accurately learning the lamp needs of the trade and then helping the A agents to stock accordingly. It has been shown that there must be greater co-operation between B and A lamp agents. The incentive to be employed to reduce the outlay for stocks will probably lie in increased remuneration to the B agents in some relation to turnover.

1919 HEATING PAD SALES SURPASS PREVIOUS YEARS

Heavy Buying of Past Few Months Reduces Accumulated Stocks, Which It Is Expected Cannot Be Filled Before January

Throughout the past year sales of electrical heating pads have been extremely encouraging and have surpassed all previous years. While definite increases in sales of 1919 over 1918 are not available in all cases, still there is a wide variation among the different manufacturers, from as low as a 25 per cent increase to as high as 300 per cent. One manufacturer, however, cannot tell the exact state of the market because he still has unfilled orders holding over from the middle of the summer. As the last three months of the year are the open season for heating pads, it is natural to expect that any increase in sales should occur during the latter part of the year. In only one case has a manufacturer reported no increase in sales for the last six months. One producer has stated that current sales are limited only by his ability to get raw materials.

Few manufacturers can ship before the first of next year. One producer, however, apparently has been building with an eye to the future, for he has been putting as many pads into stock as he could produce above current orders ever since the first of 1919. Consequently, he had a large stock as late as Nov. 1 ready for immediate shipment. Under press of heavy sales, however, he hardly expects this stock to last even to the holidays. Shipping conditions with other manufacturers are varying in both directions, for while in some cases stocks on hand as late as the middle of November permitted prompt shipment, the condition was not expected to continue beyond the first week in December. On the other hand, one manufacturer who was behind up to the middle of November because of delay in getting raw materials expected at that time to have caught up and to be able to make prompt shipment thereafter. Other manufacturers are from one to four months behind on their orders and see no opportunity for catching up within the near future.

Manufacturers advanced their prices to some extent during the year anywhere from 5 per cent, made during the early part of 1919, up to 14 per cent, effective during some of the late summer and fall months. No further price change is expected before the end of the year, or even during the first part of 1920. At the same time conditions of the labor and material market for the first quarter of 1920 cannot be predicted at this time, though an unexpected change in price of either one or both of these items would undobutedly be reflected in the selling price of heating pads.

It is generally agreed that the demand for these appliances will be especially great during the next two or three years. The market is considerably undeveloped. In the opinion of one manufacturer sales in the past few years have been created almost entirely by word of mouth, upon recommendation of a user to some friend who was ill. Now they are beginning to be known, he continues, as an every-day but extremely valuable household necessity, and it is obvious that every household using electric light is a "prospect" for one or more pads.

Another manufacturer will be disappointed if his 1920 sales are not four times those of 1918. In hospitals in particular the heating pad is rapidly gaining confidence as to its durability, safety and accuracy, and for this reason is rapidly replacing hot-water bottles.

The outlook for foreign business is very great, judging from the inquiries received by one manufacturer from other parts of the globe. From that quarter alone he expects his business next year to increase at least 35 per cent. From other quarters, too, an increase in volume of business is expected from foreign sources.

MORE AND BETTER LABOR SAVING MACHINERY NEEDED

Manufacturers' Opportunity to Develop Electrical Devices to Overcome Labor Shortage and Individual Decreasing Output

Reports show that no more favorable time than the present could be found for the development, manufacture and sale of electrical labor-saving devices and machinery. The state of the labor market is such that it is the general thing to find production curtailed not only by the shortage of certain classes of help but by the decreasing output per individual.

Recent returns from various sections of the country indicate the necessity of manufacturers' increasing their forces and advancing wages to meet the unprecedented demand for goods. Individual employees are decreasing their production from 15 to 50 per cent. One transformer manufacturer, in a test of his plant, found the coil winders turning out one-half their former product at double pay. The cost on this single item, therefore, advanced to four times its former figure.

The country is losing the services of certain classes of labor, the outlook for the replenishment of which is not very bright. In this connection the public has turned to the use of electric labor-saving and labor-replacing devices and machinery; but it is quite evident that the surface has only been scratched. What are needed are more devices, and distribution in such a way as to make it easy for the public to buy.

The importance of this work lies not only in saving labor in the household and on the farm but also to an increasing extent in the factory. It seems that the manufacturer of electrical materials and apparatus is charged with the duty of developing more and better devices to overcome the shortage of certain classes of the human element in the production of to-day and the future.

METAL MARKET SITUATION

Copper Selling at 18.25 to 18.50 Cents a Pound from Producers, With Outside Market Higher

Since the last metal market report numerous changes have occured in the price of metals. Electrolytic copper, under date of Dec. 8, is being sold by producers at 18.25 to 18.50 cents a pound for delivery at buyers' works. The unusual feature of this market is the higher price which the outside market places on its copper. These dealers have established premiums of 1 cent or more per pound for deliveries over the first and second quarters of next year. Their first quarter quotations are 19.25 to 19.75 cents and second quarter 19.75 to 20.75 cents a pound. Producers are refusing to sell to the outside market of dealers, preferring to deal directly with the consumer.

The prices of a week ago were as low as 18 cents a pound, the lowest at which the metal could be bought since its rise of several months ago. During this recent downward turn of the market from the 23½-cent level, some large sales of the red metal have been made, and consumers in many cases have covered their requirements to a considerable extent. Of course, production in some mines has decreased in the last month, and a continued coal shortage will force further reduction, it is said.

In some cases consumption during the past few months has been about on the level of production, even where this production has been normal. Prices, of course, have been sacrificed in this buying. Present domestic consumption of copper is estimated about 30 per cent greater than that before the war, the wire drawers and electrical industry being the greatest consumers. The foreign orders are, of course, very low because of the unfavorable exchange situation.

The market for copper scrap is 1½ cents lower, commensurate with the new metal prices, and heavy wire and copper scrap is quoted at 16.50 to 17 cents.

Lead prices were advanced on Dec. 6 $3 a ton, bringing the New York price up to 6.90 cents a pound. The market is strong and producers are well booked up. The outside market holds quotations up to 10 points above that of the American Smelting & Refining Company.

Antimony has advanced 1 cent to 9.50 cents a pound in a strong market, where it is improbable that large lots would be sold at carload price.

Nickel is 1 cent higher to 42 cents on quotation.

Sheet zinc shows a half-cent higher price of 11 cents. The spot spelter quotation of 8.72½ cents is nearly 1 cent higher than that of two months ago. The domestic market is unsettled, for consumers are hesitant to purchase beyond December because of fuel uncertainties. The export market is strong with pretty heavy buying, but the unfavorable exchange operates to handicap sales.

In the scrap market, the brasses are from ½ cent to ¾ cent lower, in keeping with new brass goods prices, which are from 3 cents to 5½ cents below the figures of Oct. 15.

NEW YORK METAL MARKET PRICES

	Oct. 15			Dec. 8		
Copper:	£	s	d	£	s	d
London, standard spot	105	15	0	101	10	0
	Cents per Lb.			Cents per Lb.		
Prime Lake	22.50			18.50 to 19.00		
Electrolytic	22.00 to 22.25			18.25 to 18.50		
Casting	21.50			18.25 to 18.50		
Wire base	26.00			21.50 to 22.00		
Lead, trust price	6.25			6.90		
Antimony	8.50			9.50		
Nickel, ingot	41.00			41.00 to 42.00		
Sheet zinc, f. o. b. smelter	10.50			11.00		
Spelter, spot	7.80 to 7.90			8.72½		
Tin	55.50			54.00		
Aluminum, 98 to 99 per cent	32.00 to 33.00			32.00 to 33.00		

OLD METALS

	Cents per Lb.	Cents per Lb.
Heavy copper and wire	18.00 to 18.50	16.50 to 17.00
Brass, heavy	9.50 to 10.00	9.00 to 9.50
Brass, light	8.25 to 9.00	7.50 to 7.75
Lead, heavy	5.10 to 5.25	5.50 to 5.75
Zinc, old scrap	4.75 to 5.00	5.00 to 5.25

THE WEEK IN TRADE

ESPECIALLY heavy buying is reported in the supply field, with particular emphasis on every class of material which can be used in the household. Belated shipments of appliances are coming through and temporarily filling up small gaps in the demand. It is generally realized that sufficient material for the holiday season was not ordered far enough in advance from the manufacturer to enable the jobber to accumulate stocks to satisfy the trade.

The coal strike may prove to have had more effect on the electrical trade than is now felt. Throughout the country light and power curtailing regulations and lack of fuel have already closed down some factories, while in certain sections there is merely a little inconvenience through less light and heat. Freight shipments to the West are growing longer.

Price advances are recorded on feeder and generator regulators, tape, outlet boxes, lock-nuts and bushings, silvered-glass reflectors and municipal signaling apparatus. Stocks are rather short in all lines, while, in particular, the greatest lack is felt in outlet boxes, household appliances of all kinds, small sizes of rigid conduit, flexible armored conductor, non-metallic flexible conduit, knobs and tubes. New England reports improvement in socket production. Collections in a few districts are not so good.

NEW YORK

No let-up in buying of electric material has resulted with the coming of winter. Building construction is continuing and central stations are setting meters in very large numbers for this season of the year.

Increased price changes are shown in line hardware, pole treating, lock-nuts and bushings, outlet boxes and feeder and generator regulators. Supply orders are on delivery rather than price.

Stocks on the general run of wiring material are spotty. In the item of sockets, for instance, one jobber will have deliveries of shells but no caps, while another jobber may be receiving shells from one manufacturer and caps from another and can thereby make a complete receptacle. Complete orders are not being filled on a good bit of material, but by judicious handing out the contractors are getting sufficient material for the work in hand.

The Fuel Administrator's order of Dec. 8, curtailing the use of light, heat and power, naturally had much less effect on New York City than on other communities, in that the order specified bituminous coal. Anthracite is the principal fuel of the city, except for central stations, and rather large stocks are reported.

LOCK-NUTS AND BUSHINGS.—Lower discounts the first week in December increased prices about 40 per cent.

OUTLET BOXES.—A 5 point drop in discounts on both black and white boxes increased prices about 10 per cent. Stocks are not very full.

FLEXIBLE ARMORED CABLE.—Stocks are poor, but sufficient is reported on hand and coming through to satisfy daily contractors' demands. No. 14 single strip is quoted from $86 to $95 per 1000 ft.

RIGID CONDUIT.—Steel and coal strikes have lowered the supply and output is still behind. Jobbers' stocks are spotty. One-half-inch black quotations are from $71 to $75 per 1000 ft.

WIRE.—Rubber-covered bases from ten prominent manufacturers ranged from 25 to 30 cents, with an average of 28.4 cents, showing drop in average price in the past month of about 1½ cents.

LINE HARDWARE.—The first week in December advances of 10 to 12½ per cent went into effect. Holding companies are ordering in better volume.

POLES.—Treating charges for wooden poles have gone up 20 per cent.

CHICAGO

The curtailing of light and power in Chicago and the Middle West on account of coal shortage at a time when shipments of all classes of merchandise are from a month to six months behind is crippling all business. Some electrical jobbers predict a loss of 30 per cent in business volume. In Chicago power and light have been entirely cut off from the factories, machine shops, warehouses, show windows, electric signs, etc.

Feeder regulators, tape and steel products such as outlet boxes, lock-nuts and bushings have advanced in price.

WIRE.—Prices are firm. Stocks of rubber-covered and weatherproof are in fair shape in the larger sizes. No. 14 is more plentiful than it has been but stocks are still scattered. Base prices are 30 cents for both rubber-covered and weatherproof.

FEEDER REGULATORS.—The two largest manufacturers of regulators have raised prices 10 per cent. It is reported that on a recent inquiry by a large central station a price of $1,100 each was asked on fifty regulators rated at 150 amp., 2300 volts.

TURBINES.—Nine months was the shortest time of delivery promised a large central station on a 30,000-kw. turbine of regular design, while on a special type thirteen months was promised. It is reported that a price of $27 to $28 per kilowatt with condenser was quoted.

OUTLET BOXES.—Discounts have been lowered five points on outlet boxes, making an increase in price of about 10 per cent.

LOCK-NUTS AND BUSHINGS.—Jobbers have raised prices on lock-nuts and bushings almost 40 per cent.

TAPE.—A price raise of about 12 cents has been made in friction tape, ¾-in. black tape being now quoted at about 60 cents per pound in 100-lb. lots.

SILVERED-GLASS REFLECTORS.—About 10 per cent has been added to the cost of X-ray reflectors. Strikes among Pittsburgh glass workers have made glass very hard to get.

BOSTON

Trade moves with record-breaking revenue volumes. Stocks are very much disturbed by the inability of manufacturers to make prompt deliveries. Collections are slow for this period of the year, but no serious delay is noted. The holiday retail trade is rising to unusual proportions, and jobbers are in some case practically cleaned out of electric tableware of the more common types. Wholesale buying is now almost all for next spring or late winter delivery. Prices are unstable, but show little change this week, barring readjustments of perhaps 10 per cent upward on municipal signaling apparatus. Fiber conduit is also about 10 per cent higher. Building expansion continues.

WIRE.—No. 14 is quoted at $11.50 in 5000-ft. lots, when obtainable. It is so scarce, however, that some distributers are unable to take orders for any feasible delivery.

NON-METALLIC FLEXIBLE CONDUIT.—Spasmodic shipments are coming in. The demand is heavy and the Dec. 8 quotation is $31.50 net per 1000 ft. for 5/16-in. size, in 5000-ft. lots.

FLEXIBLE ARMORED CONDUCTOR.—Single-strip material brings $85 per 1000 ft. net in No. 14 and twin-conductor, same size, $90.

SOCKETS.—Production is improving slightly and the supply for the time being is fairly satisfactory. Pulls, key and keyless sockets are respectively quoted as follows in case lots: 47.5, 30 and 27 cents.

PORCELAIN FITTINGS.—Boston is very short of this material, especially knobs and tubes. Nail-it knobs are quoted at about $16 per 1000 in standard packages.

SNAP SWITCHES.—Business is brisk, with very good stocks at present. Prices do not show much change, running around 17 per cent off list for standard package lots. In some cases very large orders are filled at a narrow margin with increased discount to 20 or 25 per cent.

FRICTION TAPE.—Little change is noted, the black, ¾-in. size bringing 47 cents per pound in 100-lb. lots. Manufacturing is keeping pretty well up with the demand. Higher prices are anticipated before long, in view of the increased cost of cotton.

FIBER CONDUIT.—The market is dull, with a few inquiries to "feel out" conditions. Prices advanced about 10 per cent within a few days, due, it is said, to the increasing scarcity of wood pulp.

ATLANTA

Despite the drastic ruling made effective by the Regional Coal Committee Dec. 1, and applying to practically every industry in the Southeast, jobbers report continued brisk demands for all lines of electrical material.

The effects of the steel strike are beginning to be felt and advances in prices are noted in several lines into which steel products enter. Plans for additional industrial and commercial expansion and good cotton and food products crops indicate an indefinite continuation of business activities.

WIRE.—While the demand in the popular sizes of weatherproof No. 6 to No. 10 continues strong, a slight break in prices is to be noted on rubber-covered. It is stated that this break was probably caused by jobbers having stocks of rubber-covered on hand which they are anxious to move. Rubber-covered is quoted at 28 cents; weatherproof, 31 cents.

BOXES AND COVERS.—The effect of the steel strike is felt in this line, and as a result prices have been advanced 10 per cent, effective Dec. 2. The demand for these fittings continues steady and stocks throughout the territory are in good shape.

LOCK-NUTS AND BUSHINGS.—These articles are also quoted at an advance in price of 25 per cent, effective Dec. 2.

FRICTION TAPE.—The demand for friction tape is reported brisk. Stocks are in fair condition and shipments good. Jobbers are quoting prices as follows: 5-24 lb., ¾-in., 60 cents per pound.; 25-100 lb., ¾-in., 50 cents per pound.

SEATTLE

Sales of electrical merchandise, particularly domestic appliances and tableware for Christmas gifts, which have been mounting during the past six weeks, during the past week established a higher mark. The majority of jobbers and dealers assert the peak has not yet been reached in spite of the heavy movement, which far exceeds the volume of former years. Orders placed for Christmas merchandise some time ago are being filled comparatively satisfactorily, although dealers are apprehensive about stocks being equal to the last week of holiday demand. The volume of sales of house-wiring devices showed a noticeable increase over the past two weeks. Sales of air heaters also showed renewed impetus because of the unusually cold weather of the past week. In fact, one jobber and several retailers report stocks entirely depleted on this commodity.

The Portland district reports a great deal of difficulty being experienced in receiving freight shipments from the East because of the coal shortage. Prices on insulated wire remain unchanged. No decrease in price is likely owing to shortage of stocks. It is predicted, however, that this shortage will be largely overcome within the next month or two. There has been considerable activity shown in the movement of electric ranges. A large delayed shipment of washing machines has just arrived. The situation regarding appliance stocks, however, is growing worse, in face of the strong demand.

SAN FRANCISCO

A large proportion of shipyard workers have returned to work, although it cannot yet be definitely said that the strike has been broken. Still there can be no doubt that shipyard conditions are resuming their normal appearance. In fact, the first vessel to be launched since the strike began in October hit the water during the past week.

The value of building permits for the month of November 1919 for the three principal coast cities is as follows: San Francisco, $2,050,809; Los Angeles, $5,232,539; Oakland, $595,465. The 1918 parallel figures were: San Francisco, $172,144; Los Angeles, $519,008; Oakland, $298,777.

The effect of the coal strike is being indirectly felt in the movement of trains carrying goods. It now takes one and a half months for carload shipment from Chicago, with rare exceptions.

FARM PLANTS.—Of all material on which poor deliveries have been the rule during 1919, farm plants and washing machines have been about the worst. Very carefully organized and intensive campaigns by farm plant agents are now being carried on with much local advertising.

HOLLOW-WARE DEVICES.—From present indications, the year will be disappointing through lack of stock.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Two-Gang Toggle Switch

A two-gang-type toggle switch which is especially adapted for use in closed automobiles but which has other uses has been brought out by Harvey Hubbell, Inc., of

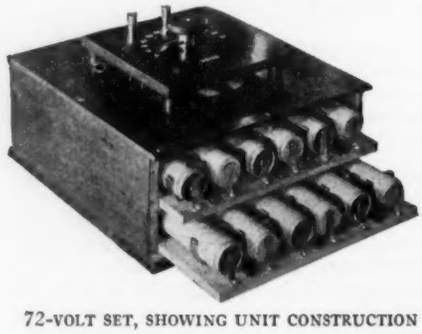
TOGGLES COUNTERSUNK IN CURVED RECESSES

Bridgeport, Conn., and will be listed as No. 8022. The handles of the new switch are countersunk in curved recesses, adding to its appearance.

Dry-Cell Potential Sets

The dry-cell potential sets now being made by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., have been developed primarily for use with its Compton quadrant electrometer, but have other applications in electrical measurements where a steady potential of small current capacity is desired. They are supplied in units giving potentials as high as 144 volts, in two general types—one giving potentials in steps of 6 volts up to the maximum, and the other type giving one potential per set, that is, the potential of all of the cells in series.

Within hard-wood boxes are the trays, which each contain six tubes of dry cells, each tube containing four cells. These cells are of the standard size usually em-



72-VOLT SET, SHOWING UNIT CONSTRUCTION

ployed for pocket flashlights and may be replaced by such if desired. Each tube of cells is held in place by spring clips and so is easily removable from the two trays, which may be withdrawn far enough from the box to give access to the tubes.

For giving various potentials a dial-type construction is employed, a pointer and markings being used on an ebonite switch base which is mounted upon the top of the box.

The circuit is not broken between steps, it is pointed out, so that the new sets are well adapted for use with an electrometer where it is convenient to keep a potential constant on the instrument. A resistance is in series with each tube to insure that the cells individually will not give more than 0.1 amp. even on short circuit, any current up to that value being allowable for constant use.

Suction Cleaner with Wide Nozzle

An improved "Sloane" electric vacuum cleaner, licensed under the Kenney patents, is now being made by W. & J. Sloane,

HOSE CONNECTED TO TURBINE FAN BY REMOVING NAME PLATE

Fifth Avenue and Forty-seventh Street, New York City.

It uses a General Electric universal-type motor, air-cooled by a small fan. Five air vents allow the air to be circulated through the motor by this fan. The nozzle has been made 13½ in. (34 cm.) wide to facilitate rapid cleaning and is equipped with a removable stationary brush. An adjusting screw regulates the height of the nozzle from the floor. The cleaner runs on three large rubber-tired wheels.

The dust bag is made of a special fabric designed to allow no dust to penetrate. The handle of the cleaner has a "pistol grip" equipped with a switch for starting and stopping. The new cleaner can be obtained with eight attachments of useful character.

Vacuum Cleaner with Swivel Rear Wheel

The addition of a swivel rear wheel on its electric vacuum sweeper is announced by the Federal Electric Company of Chicago. This is designed to make the cleaner more efficient and easier to operate, making it possible for the operator to turn the machine in any direction without deranging rugs, carpets, etc.

Vacuum for Cold Junction of Thermocouple

For insuring constant cold-junction temperature the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., is now offering a "Ferrostat" vacuum bottle complete with fittings. This bottle, the maker declares, is unbreakable and when filled with cracked ice will maintain the cold junction of a thermocouple at 0 deg. C. (32 deg. Fahr.) for twenty-four hours.

Standard Edison-Base Cleat Receptacle

A standard Edison-base cleat receptacle with a capacity of 660 volts on 250-volt circuits has been developed by the Kirkman Engineering Corporation, 237 Lafayette Street, New York City, and is known as K-E No. 50715. It is constructed of heavy porcelain and has exposed terminals. All contacts are of heavy-gage metal and designed for heavy duty. The receptacle is for use on open wiring and cleat work and is approved by the National Board of Fire Underwriters.

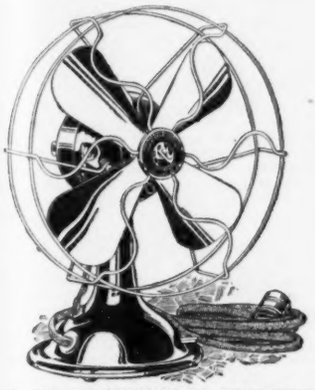
Eight-Inch Series Universal Fan

A series universal type 8-in. (20-cm.) electric fan has been developed by the Robbins & Myers Company of Springfield, Ohio. It operates on direct current of 100 volts to 120 volts and on alternating current of any frequency from 25 cycles to 60 cycles and any voltage from 100 to 120. On direct current the speed of the fan is 1950 r.p.m. and on alternating current 1850 r.p.m.

Special attention has been given to the lubrication of the new fan. An oil reservoir is cast in each hub opening into the bearing. Felt packed in the reservoir bears against the journal, retaining the oil and feeding it to the bearing. The oil is dropped into the reservoir through a hole in the top of the hub.

A hinge joint permits the fan to be adjusted vertically. A switch in the base is used for starting and stopping and gives operating positions for direct current and

alternating current. The fan's frame and base are made of cast iron with a black enamel finish. The blades are of steel with an oxidized finish, and the guard is made of steel and has a black enamel finish. Rubber feet are supplied on the fan base. The weight of the fan is 6 lb. (2.7 kg.). Eight feet (2.4 m.) of black



OIL FED TO BEARING BY FELT WICK

code reinforced cord with a separable plug is provided.

The new fan is also made for operation on 32-volt direct-current circuits.

Portable Electric Heater with Two Coils

Instead of one heating unit, the No. 8 portable radiant electric heater made by the Majestic Electric Development Company of Philadelphia and San Francisco has two coils, each rated at 480 watts. The new heater stands 17½ in. (44 cm.) high, has a parabolic reflector of copper with a diameter of 13 in. (33 cm.) and weighs 6¾ lb. (3 kg.).

Decorative Electric Fans

To meet the demand for electric fans which will harmonize with decorative schemes L. Plaut & Company, 432 East Twenty-third Street, New York City, have brought out a "de luxe" line of fans consisting of 10, 12 and 16-in. (25, 30 and 40-cm.) oscillating fans of Westinghouse make, incased in ornamental "compo" and finished in various manners.

A series of standard period designs has been produced and special designs to suit original decorative plans can be secured.

Portable Electric Drills with Stop Switch

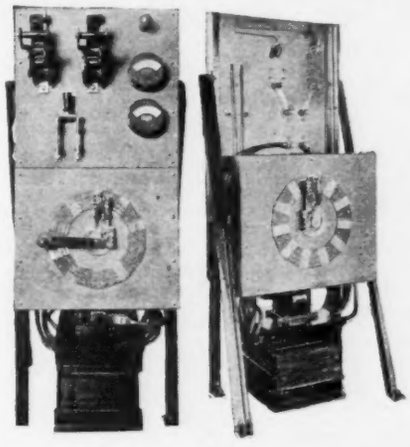
A line of portable electric drills in ¼, ⅜, ½ and ⅝ in. (6.3, 9.5, 12.7 and 15.8 mm.) sizes has been announced by the Wodack Electric Tool Corporation, 25 South Jefferson Street, Chicago. A feature of the drills is the automatic stop switch which forms a component part of the top handle. It is operated with the palm of the hand as pressure is applied, and when pressure is released the switch automatically shuts off the current.

These drills are run by series laminated-type universal motors. A forced-draft cooling fan and air passage system of ventilation is used. Equal tension of the brushes against the commutator, as they wear down, is said to be secured by an adjustable brush holder. The ball bearings are self-cooling. Gears run in a liquid-tight grease compartment, in order to protect the motor windings from injury.

The drill gears are of chrome nickel steel. Castings are of aluminum alloy. The almond-geared nut chuck is designed for rigidity.

Voltage Regulator for Auto-Transformer Control

For varying the voltage applied to transformer devices over a 100 per cent range in small increments continuously, the American Transformer Company, 178 Emmet Street, Newark, N. J., has developed a combination of two interlocking radial switches with one or more auto-transformers having coarse and fine steps. Because of the way in which the switches are interlocked, the maker states that only one switch need be operated to withstand



FRONT AND BACK VIEW OF SWITCH PANEL SHOWING BOTH REGULATING SWITCHES

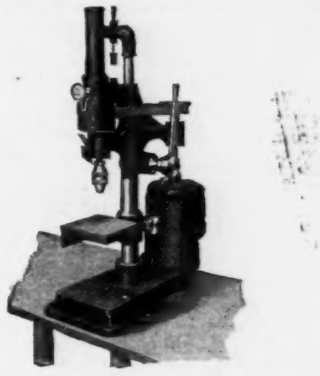
a practically continuous variation in voltage in small increments.

The transformer is provided with a number of coarse steps, and one of the coarse steps is further subdivided into fine steps. It is possible by this means to vary the voltage of the load circuit from zero to 100 per cent in 1 per cent steps over the entire range, with two radial switches, one for the coarse and the other for the fine adjustment. In most cases it is necessary to go from step to step without opening the circuit between steps and without short-circuiting the taps on the transformer.

The accompanying illustration shows the front view of a switch panel, the lower section of which contains the fine regulating switch. Directly in back of this switch is another panel upon which is mounted the coarse regulating switch which is also shown. These illustrations show the type of switch used for a 100-kva., 220-volt installation where two separate auto-transformers are employed, one for the coarse steps and another one for the fine steps. These are shown in the illustrations, where they appear mounted directly beneath the switches.

Motor-Driven Bench Drill Press

A two-speed, direct-motor-driven, high-speed, ball-bearing sensitive bench drill press for drilling holes up to ¼ in. (6 mm.) has been developed by the High Speed Hammer Company of Rochester, N. Y. It is equipped with a Robbins & Myers



EQUIPPED WITH BALL BEARINGS

electric motor, mounted vertically, and can be furnished with special pulleys to drive the main spindle any speed up to 10,000 r.p.m. The drill press is operative by either hand or foot control.

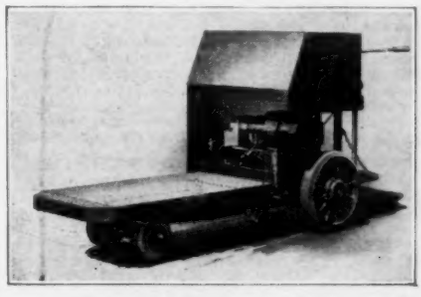
The drill press has an adjustable table with a working surface 5½ in. (139 mm.) by 5 in. (127 mm.) and will take work up to 4⅜ in. (111 mm.) in height. The ground working surface of the base is 4 in. (101.6 mm.) by 6 in. (152 mm.) and takes work as high as 7½ in. (190.5 mm.).

So that drills can be quickly changed without the operator's hands coming in contact with the belt or pulleys a spindle lock is placed on the new drill press.

The new machine, known as model E-50, weighs 62 lb. (28 kg.) and is 24 in. (0.6 m.) high.

Elevating Mechanism for Electric Trucks

For installation in an electric truck the Elwell-Parker Electric Company of Cleveland has brought out a motor-driven mechanism for raising or lowering loads up to 4000 lb. (1814 kg.) to a predeter-



ELECTRIC TRUCK SHOWING LIFTING MECHANISM

mined height by the simple movement of a hand lever. The mechanism may be removed as a unit from an electric truck and consists of a lever, electric switch, motor and worm speed reducer.

Manufacturers' Activities

REEDS & THORPE, 904 Main Street, Hartford, Conn., is the name of the firm just organized by Clarence Reeds and George W. Thorpe, power engineers.

THE LAKEWOOD ENGINEERING COMPANY, Cleveland, Ohio, is offering three awards, totaling $1,750, for the three best analyses of the application of its new Tier-list truck.

THE GIBB INSTRUMENT COMPANY, Detroit, Mich., announces the discontinuance of its line of electric pyrometers in order to confine its efforts entirely to the manufacture of welding apparatus.

WALTER L. MELVIN has been appointed superintendent of the Hygrade Lamp Company, Salem, Mass., reporting to the factory manager. Mr Melvin was formerly superintendent of the Franklin Electric Lamp Company's Hartford (Conn.) factory.

THE YARNALL-WARING COMPANY, Chestnut Hill, Philadelphia, manufacturer of power-plant devices, announces that L. G. Chase, formerly efficiency engineer, Rosemary Manufacturing Company, Rosemary, N. C., has been appointed mechanical engineer of this company.

THE AUTOMATIC ELECTRIC FAUCET COMPANY, Berkeley, Cal., will on Oct. 1 move into its new factory at 2927 Newberry Street, that city. The new factory will give 7500 sq. ft. of factory space, permitting it to produce electric hot-water heaters in quantities to meet present demands. W. F. Garby is manager.

HORACE G. COOKE announces the organization of Horace G. Cooke, Inc., 50 East Forty-second Street, New York City, to design and market for the National Marine Engine Works, Inc., a complete line of rotary compressors (blowers), gas exhausters and pumps. He also announces his withdrawal from the Connersville Blower Company after twenty years' service as Eastern representative.

THE ATLANTIC SALES COMPANY has organized as manufacturers' agents with offices and warehouse at Fifty-ninth Street and Woodland Avenue, Philadelphia. It is distributer for the Kentucky Electric Lamp Company, the A. F. Daum Manufacturing Company, the Hart Manufacturing Company, the Mica Manufacturing Company and the Arts Electrical Company. M. F. Knapp and J. C. Vogel are the organizers of the firm.

THE JANETTE MANUFACTURING COMPANY, Chicago, manufacturer of alternating-current and direct-current motors and motor-generators, is moving into its new factory building at 556 West Monroe Street. This is a seven-story and basement building, comprising 60,000 sq. ft of floor space, or about six times the amount of floor space occupied in the old West Jackson Boulevard Building. In addition to increased space, the company is adding considerable new equipment for a much larger production. In order to satisfy the present demand, the output will be increased at least 500 per cent, according to advices from the Janette company.

CO-OPERATIVE ADVERTISING CAMPAIGN.—One of the first steps in co-operative advertising, and one which might lead to interesting developments along the same line, was recently undertaken by the Western Electric Company in the pole-line tool field. The lines advertised at the same time were Oshkosh, Klein and Burke. Each of these lines is used for a different part of pole-line construction and work, one being picks, shovels and similar construction tools, another pliers, wire cutters and similar wireman's tools, and the third consisting of belt and climber straps and similar lineman's leather goods. Since the lines do not overlap, it is possible to advertise a complete service and at the same time allow the manufacturer to advertise his product in its proper relation to the job.

THE WOODHOUSE ELECTRIC COMPANY, INC., Norfolk, Va., has increased its capital stock from $50,000 to $150,000.

J. BENTON PORTER, ship-propulsion specialist, has been transferred from the Philadelphia office to the New York office of the General Electric Company.

THE EISEMAN MAGNETO CORPORATION, manufacturer of high-tension magnetos, is issuing $1,500,000 worth of 7 per cent cumulative sinking-fund preferred stock.

THE CHICAGO PNEUMATIC TOOL COMPANY on Oct. 1 removed its Birmingham office from the Brown Marx Building to 1925 Fifth Avenue, North, where a service station and complete stock will be maintained.

THE NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS will hold its first annual lighting fixture market (chandelier show) at Detroit, Mich., Feb. 9 to 13. Charles H. Hofrichter is secretary-treasurer of the council. This convention is held at the same time as that of the Lighting Fixture Dealers' Society of America and the Illuminating Glassware Guild.

THE DOMESTIC ENGINEERING COMPANY, INC., Dayton, Ohio, manufacturer of the Delco electric light products and distributer for the company in forty-eight cities in the United States, has been cited by the Federal Trade Commission in a complaint charging unfair competition and alleging a nation-wide system of resale price maintenance to the detriment of competitors. The concern was directed to file answer with the commission at Washington Nov. 11.

THE HYATT ROLLER BEARING COMPANY, New York City, announces the appointment of Earl E. Eby, sales manager of the industrial bearings division, to the board of directors of Hyatt, Ltd., a new company formed to market the Hyatt bearing in Europe. Mr. Eby will devote his entire time to this work, with headquarters in New York. G. O. Helmstaedter, formerly Chicago district manager, has been promoted to the position of sales manager to fill the vacancy.

WESTINGHOUSE CHANGES.—H. U. Hart, chief engineer of the Canadian Westinghouse Company, Ltd., has been appointed general manager, succeeding Mr. Merrick, resigned. Mr. Merrick, however, remains vice-president and a member of the board of directors of the company. C. H. Mitchell, formerly assistant superintendent of electrical department, has been appointed assistant manager of the Canadian company's works. R. E. Cullings has been appointed general foreman in charge of the electrical department at the Essington works. H. C. Thomas has been appointed assistant to the manager of the St. Louis office.

THE BOOTH ELECTRIC FURNACE COMPANY has opened up the following district offices in connection with the sale of electric furnaces for melting steel, iron and non-ferrous metals: For New York and New England, Edward B. Stott & Company, Flatiron Building, New York City, with E. F. Tweedy, secretary of the company, directly in charge; for eastern Pennsylvania, New Jersey, Maryland, Delaware and the southern Atlantic Coast states, Northern Engineering Company, 308 Chestnut Street, Philadelphia, with F. W. Doran in charge; for northeastern Ohio, western Pennsylvania and western New York State, Charles L. Foster, formerly sales manager of the Electric Furnace Company of Alliance, Ohio, with offices at 879 Arcade, Cleveland, Ohio. In connection with these district offices a complete staff of engineers and metallurgists will be maintained so that the needs of customers can be promptly met and adequately taken care of.

THE BLACK & DECKER MANUFACTURING COMPANY, Baltimore, Md., announces that it is giving to its stock jobbers, for the prominent display of the company's tools in their stores, a metal display rack. This carries an electric valve grinder and four different sizes of portable electric drills.

THE LAPP INSULATOR COMPANY, INC., Le Roy, N. Y., announces the appointment of S. H. Lanyon, 507 New Call Building, San Francisco, as its representative for the Pacific Coast; the Capital Electric Company, Salt Lake City, representative for the Salt Lake district, and the Butte Electric Supply Company, Butte, Mont., for the State of Montana.

HAYNES L. EVEREST has just been appointed general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn. Although a native of the East, Mr. Everest has resided in Chicago for the past twelve years. He joined the sales force of the Hart & Hegeman Manufacturing Company on Jan. 29, 1907, with headquarters in Chicago. Previous to his coming to this company he was connected with the New York, New Haven & Hartford Railroad Company at New Haven for about five years. In October, 1914, owing to the death of George S. Searing, the company's Western representative, Mr. Everest was made Western sales manager, which charge he has held continuously since. He will make his new headquarters at Hartford, Conn. Arthur E. Lubeck succeeds Mr. Everest as Western sales manager at Chicago. Mr. Lubeck was formerly assistant Western sales manager and for many years has been in the electrical business in the Middle West.

H. L. EVEREST

THE NEW YORK ELECTRICAL CREDIT ASSOCIATION MEMBERSHIP CAMPAIGN.—Efforts are now being made by the New York Electrical Credit Association to increase greatly its membership among electrical manufacturers and jobbers. Dues have been advanced to $60 annually in order to enable the association to better its service. The committee chairmen in chrage of the several activities in the membership campaign are H. G. Green (H. W. Johns-Manville Company), chairman of the general committee; William L. Goodwin (General Electric Company) and Robert Edwards, Jr. (member of national board of managers), general advisers; W. R. Conklin (Waclark Wire Company), chairman of committee on expanded service; H. T. Hochhausen (Brooklyn Electrical Supply Company), chairman of committee on selecting prospects, and F. A. Booth (Westinghouse Electric & Manufacturing Company), chairman of committee on meetings; Franz Neilson, secretary of the association, chairman committee on publicity; President Harding (Westinghouse Lamp Company) and Franz Neilson, members ex officio of all committees.

Supply Jobbers' Notes

RICHARD D. DAVIS has been promoted to the post of sales manager of the Lewis Electrical Supply Company, Boston, Mass., one of the largest jobbing houses in New England. Mr. Davis was purchasing agent for electrical materials in the construction of the Boston army base and for several years has been active in the sales department of the Lewis organization.

W. F. ABELY has been appointed assistant manager of the Western Electric Company at Boston, Mass. Mr. Abely is widely known in New England jobbing circles, having been in charge of sales at the company's offices in South Boston for a number of years and an active worker for the upbuilding of the electrical industry through its commercial organizations.

FOSTER-McDONALD COMPANY OCCUPIES NEW QUARTERS.—The electrical supply jobbing house of the Foster-McDonald Company has moved into new quarters at 174-6 Congress Street, Boston, Mass., and is enlarging its sales force and connections. In its new location the street floor and basement, aggregating 10,000 sq. ft. of floor area, will be utilized, giving the company eight times its former floor space. Among the new agencies which have been taken over by the company are the Duncan watt-hour meter, Royal Electric Suction Cleaner, Lewis & Roth busbar fittings and supports, and the Trumbull-Vanderpoel line of knife switches, panelboards and fittings. This house is also handling the New England agency for Maloney transformers and Rutenber electric ranges. An order for 125 Rutenber electric ranges has recently been placed with the Foster-McDonald Company by the Central Maine Power Company, and about two-thirds of the shipment will be consigned to the town of Belfast. These ranges include various sizes from the three-hole hot-plate design to six-unit heavy-duty ranges.

Foreign Trade Notes

VACUUM CLEANERS FOR SCOTLAND. — A heavy demand for vacuum cleaners exists in the region of Dunfermline, Scotland.

THE LAHORE ELECTRIC SUPPLY COMPANY, LTD., Lahore, India, is placing inquiries for generating equipment of 3000 kw. capacity for substation apparatus and feeder copper.

THE HAMILTON LAMP COMPANY, LTD., 146 York Street, Hamilton, Ont., has commenced operations in the manufacture of nitrogen-filled tungsten lamps. G. W. Nichol is sales manager of the company.

GERMAN LAMP WORKS AMALGAMATION. — Germany's principal electric lamp factories, the A. E. G. special branch and the Auer and Osram firms, are to combine, according to reports, as one company to fight foreign competition.

MARKET FOR ELECTRICAL SUPPLIES IN NEW ZEALAND.—There is said to be a shortage in the New Zealand market of electrical materials for the equipment of homes for returned soldiers. Most of this fixture and supply material during the past four years has come from the United States.

RUMANIA'S NEED FOR ELECTRICAL EQUIPMENT.—Electric power plants are greatly in demand in Rumania, and British manufacturers have already sent several representatives of British firms there to sell their goods. Besides there is an acute lack of all electrical apparatus from generators to electric fittings and of domestic telephone sets and electric bells. There is much undeveloped water power available. Immediate requirements include insulated wire and cables, tubing, switches, motors, transformers, metal-filament lamps, telephones, electrical heating and cooking apparatus, fans, etc.

ELECTRICAL IMPORTS INTO CHINA SHOW INCREASE. — Electrical material imported into the Canton consular district during 1918 showed improvement over 1917. Fans and accessories increased from $30,300 to $51,860; other materials from $185,900 to $205,800; telegraph materials from $299 to $7,000.

IMPORT PERMITS NOT REQUIRED ON ELECTRICAL APPARATUS TO POLAND. — It is announced that permits from the Polish government are not now required for the importation of various classes of goods into Poland, including electrical plant supplies for electrical installations, scientific and drawing instruments, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired by a man in Spain (No. 31,358) for the sale of electrical goods. Correspondence should be in Spanish or French.

The purchase is desired by a firm in Lettland (No. 31,326) of electrical fixtures and supplies. Correspondence should be in Russian or German.

Samples, catalogs and price lists are desired by a man in Spain (No. 31,332) with a view to representing firms for the sale of electrical supplies. Correspondence should be in Spanish.

An American firm of purchasing agents for a manufacturing company in Brazil (No. 31,364) desires to secure catalogs and quotations in duplicate for the purchase of machinery for the production of insulators.

The partner of a firm in Uruguay (No. 31,279) will shortly arrive in the United States and desires to secure agencies for the sale of electric lighting plants for farms. Quotations should be given c. i. f. Montevideo. Correspondence may be in English.

An American firm in Poland (No. 31,346) which is planning to erect a machine shop desires to secure an agency, purchasing goods outright, for the sale of electrical equipment. Quotations should be given f. o. b. New York. Payment, cash. Reference. Catalogs and price lists are requested.

A manufacturer in Spain (No. 31,345) desires to secure an agency for the sale of motors and generators, electric-heating apparatus, electrical conductors, electric lamps of ½ watt and 1 watt, insulated and enameled copper wire on bobbins and resistance wires. Correspondence should be in Spanish.

Trade Publications

BALANCING APPARATUS. — The Vibration Specialty Company, Harrison Building, Philadelphia, has issued a booklet about its "Akimoff" balancing apparatus.

HOUSEHOLD APPLIANCES. — The Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, has issued a new catalog of "Hotpoint" electrical appliances.

COMPRESSORS. — The Ingersoll Rand Company, 11 Broadway, New York City, has issued form 945, illustrating its E. R. & F. R. air compressors for small machine shops, power houses, garages, etc.

REFLECTORS. — The Pittsburgh Reflector & Illuminating Company of Pittsburgh, Pa., has published a calculator to indicate the correct "Pittsburgh" reflector for show windows of various sizes.

COMPRESSOR.—The Bastian Auto Engineering Works, Olney Station, Philadelphia, describe their 101-T-U automatic stationary air-compressing outfit in a recently issued leaflet.

CONTROLLER. — The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., is circulating a leaflet telling about its line of alternating-current and direct-current drum controllers.

THEATER LIGHTING.—The Major preselection system of remote control for theater lighting is the subject of a booklet which has been published by the Major Equipment Company of Chicago.

COMPRESSORS. — The electrically operated air compressors manufactured by the Bastian Auto Engineering Works, Olney Station, Philadelphia, are both illustrated and described in a recently issued folder.

PORTABLE CABLE. — "The Proof of the Pudding" is the title of a booklet recently published by the Tubular Woven Fabric Company of Pawtucket, R. I., to give the advantages of its Duracord portable cable.

PORTABLE MOTOR.—The Toledo Pipe Threading Machine Company, 1425 Summit Street, Toledo, Ohio, has issued an illustrated circular about its "Toledo Power Drive," a portable motor for operating pipe threading and cutting tools.

OIL SWITCHES.—Type E-4 oil switches and circuit breakers, whose maximum ampere capacity has recently been increased to 800, are covered in bulletin No. 414-2, being distributed by the Condit Electrical Manufacturing Company of South Boston, Mass.

INTER-OFFICE TELEPHONES, ETC. —The Dictograph Products Corporation, 220 West Forty-second Street, New York City, has issued an illustrated folder about its products, which include telephones for offices and motor cars and acoustic apparatus for the deaf.

New Incorporations

THE DEVINE (TEX.) ELECTRIC & ICE COMPANY has been incorporated with a capital stock of $23,000 by Charles Becker and others.

THE PADUCAH (KY.) ELECTRIC COMPANY has been chartered with a capital stock of $1,200,000 by Alfred S. Nichols, Charles K. Wheeler and Robert W. Kirkland.

THE KENTUCKY & WEST VIRGINIA POWER COMPANY of Hazard, Ky., has been incorporated with a capital stock of $6,000,000 by Bailey P. Wootton, Harry T. Taylor and J. G. Greene.

THE ELECTRIC SMELTING & ALUMINUM COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by Charles Hine, J. Frank Pease, Stanley L. Orr and others.

THE LEE (ILL.) POWER & LIGHT COMPANY has been incorporated by David L. Heburg, James E. Johnson and Emanuel Anderson. The company is capitalized at $10,000 and proposes to supply electricity in Lee.

THE HUDSON ELECTRICAL SHOP & EQUIPMENT COMPANY of Hoboken, N. J., has been incorporated by A. T. Pupke of Hoboken; W. E. Stanton and W. J. Coleman of Jersey City, N. J. The company is capitalized at $50,000 and proposes to do a general electrical engineering business.

THE WHITEWATER VALLEY POWER COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of $10,000 by Charles A. Hinsch and others. The company proposes to erect an electric transmission line from the power line of the Union Gas & Electric Company from Elizabeth to Harrison to furnish electricity in the latter town.

New England States

CHESTER, VT.—The Chester Water & Light Company is contemplating the installation of three 100-kva., three-phase, 11,000/1100-volt transformers and construction of outdoor-type substations in the spring of 1920. E. J. Davis is manager.

JOHNSON, VT.—The village of Johnson is contemplating the purchase of material for the municipal electric light plant, including cedar poles, 25 ft., 2-in. tops, two-pin cross-arms and wire for 2½ miles of line, and a year's supply of incandescent lamps. Morris S. Hill is manager.

MOUNT HOLLY, VT.—The West River Power Company, recently incorporated, with a capital stock of $5,000, proposes to supply electricity in the towns of Londonderry, Jamaica, Wardsboro, Shrewsbury and Mount Holly. Electricity to operate the proposed system will be purchased from the Colonial Power Company, which operates a plant at Cavendish Gorge. The main office of the company will be at Mount Holly. The cost of the transmission lines with meters is estimated at about $40,000.

ST. JOHNSBURY, VT. — The Twin State Gas & Electric Company is contemplating extensions to its St. Johnsbury plant, including the installation of two waterwheels, one of 700 hp. and one of 490 hp.; two generators, one 400-kw. 2300-volt, and one 300-kw. 2300-volt. Barry, Cashman & Company of Boston, Mass., are contractors. I. W. Jones of Milton, N. H., is engineer in charge.

SOUTH LONDONDERRY, VT.—C. H. Kingsbury, owner of the local electric light plant, contemplates the purchase of materials for 5 miles of overhead line and about 20 meters. W. H. Landman is engineer in charge of work.

Middle Atlantic States

BATH, N. Y.—At an election held recently the proposal to issue $35,000 in bonds to enlarge the municipal electric plant was carried.

FILLMORE, N. Y.—The Genesee Valley Power Company has purchased the water rights of Wiscoy Falls, about 5 miles from Fillmore. It is estimated that about 600 hp. can be developed. The company also contemplates extending its transmission lines to Belfast, Angelica and Belmont.

OGDENSBURG, N. Y.—The construction of a new power plant is among the many improvements contemplated for the St. Lawrence State Hospital during the coming winter and spring. Dr. Paul G. Taddiken is superintendent.

ROCHESTER, N. Y.—The Starter & Ignition Service Company, 437 East Main Street, has acquired a site in North Union Street, near East Avenue, on which it proposes to erect an electrical station.

SOUTH RIVER, N. J.—The Board of Public Works has submitted a report to the Mayor and Borough Council recommending extensions to the municipal electric light plant, involving an expenditure of about $140,000.

LEBANON, PA.—The Metropolitan Edison Company is contemplating erecting a high-tension system in Lebanon. The company now furnishes electricity here.

NEW WILMINGTON, PA.—The Council contemplates making changes to the municipal electric lighting system, changing it from direct to alternating current. It is proposed to purchase electricity from the plant at New Castle. J. B. Anderson is engineer of the power station.

PHILADELPHIA, PA. — A permit has been granted the Stone & Webster Engineering Corporation for the construction of the new power house of the Philadelphia Electric Company, to be located on Beach Street below Palmer Street. The building will be five stories, 410 ft. by 490 ft., in four parts, all connected. The cost is estimated at $2,500,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PITTSBURGH, PA.—The Consolidated Ice Company is planning to equip its three plants in Pittsburgh for electrical operation during the coming winter. Steam power is now used.

SEWARD, PA. — Contract has been awarded by the Penn Public Service Corporation of Clearfield to Dwight, Robinson & Company, 61 Broadway, New York, N. Y., for the construction of a power house, to be located in Seward. The proposed plant will have an ultimate capacity of 100,000 hp., divided into four units of 25,000 hp. each. The initial installation will have a generating capacity of 50,000 hp. To supply this plant with fuel the company has purchased mines at Robindale. The proposed plant will supply electricity in Somerset, Cambria, Indiana, Westmoreland, Clearfield and Center Counties.

WILKES-BARRE, PA.—Plans are under consideration by the Wilkes-Barre Company to place its wires underground on the Public Square, on South Main Street as far as Northampton Street and possibly to Ross Street. A movement has been started by the company to place its large power cable underground on South Main Street so that the merchants on that thoroughfare can erect electric lamp standards similar to those on the Public Square. E. A. Wakeman is general manager.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company is contemplating extensions and improvements to its plants and systems. The proposed work will include the installation of ten 500-hp. Edge Moor boilers, ten Detroit stokers, C. W. Hunt Company coal-conveying equipment, three 4000-kw. General Electric turbines, three General Electric 5000-kva., 60-cycle, 2300-volt generators, switchboard equipment and transformers. About fifty substations will be erected over the coal field of Logan and Mingo Counties and also a part of Boone County. About 100 miles of 44,000-volt transmission line will be erected and about 1000 General Electric meters used. The company will require electrical supplies, costing about $75,000, for its own use. The main plant of the company is in Logan. John R. Adams is engineer in charge.

BEDFORD CITY, VA.—Extensions are contemplated to the municipal hydro-electric plant at Snowden, including the installation of 375-kva., three-phase, 60-cycle, 2300-volt generator, a new waterwheel and waterwheel governor, two transformers, and additions to switchboard. W. C. Whitner of Richmond is engineer in charge, C. E. Harris is superintendent.

FREDERICKSBURG, VA.—The Spottsylvania Power Company is considering the purchase of a 500-kva., 25-cycle, 2300-volt, steam-turbine unit (new or second hand). W. Key Howard is superintendent.

GLENN LYN, VA.—Arrangements are being made by the Appalachian Power Company of Bluefield, W. Va., for an addition to its local steam-driven electric plant. New equipment, including a 20,000-kw. General Electric turbine, etc., will be installed. Contract has been awarded to Viele, Blackwell & Buck, engineers, 49 Wall Street, New York, N. Y. The cost of the work is estimated at about $600,000.

PORTSMOUTH, VA. — Improvements recommended by Burton Marye, engineer State Corporation Commission, for the street railway system will be made by the Virginia Railway & Power Company. The cost is estimated at $88,000.

WASHINGTON, D. C.—Extensions and improvements, involving an expenditure of about $1,100,000, are contemplated by the Capital Traction Company. The proposed work will include additional power equipment, to cost $300,000; reconstruction and repairs of tracks, $300,000, and the purchase of forty new cars, $500,000.

North Central States

LAKE LINDEN, MICH.—The Houghton County Electric Light Company is contemplating the erection of a substation in Lake Linden. The company will also remove the poles from the county road between Larium and Lake Linden and erect them on the right-of-way of the traction company.

MONTGOMERY, MICH.—The Economy Electric Company is contemplating the erection of an electric transmission line to Roy, a distance of 4 miles. S. P. Hull is manager.

SAULT STE. MARIE, MICH.—Bids will be received by the City Commission of Sault Ste. Marie until Dec. 22 for furnishing electrically operated centrifugal pumping equipment as follows: (A) One unit to deliver 2000 gal. per minute against 183 ft. total head; (B) one unit to deliver 2800 gal. per minute against 183 ft. total head; (C) one unit to deliver 3700 gal. per minute against 183-ft. head; (D) one unit to deliver 4000 gal. per minute against 80-ft .head. Specifications may be obtained from A. J. Eaton, city clerk.

TORONTO, OHIO.—Arrangements are being made by Follansbee Brothers Company of Follansbee, W. Va., for the construction of a new steel plant at Toronto, to cost about $5,000,000. The buildings will include a machine shop, open-hearth and hot mills, annealing departments, scrap shed and power plant, about 60 ft. by 100 ft.

HAZARD, KY.—The Kentucky & West Virginia Power Company is planning to enlarge its electric generating plant at Lothair. The company, it is said, will extend its electric transmission lines through the Elkhorn and Hazard coal fields and on through the Pike County coal fields and into the Elkhorn field of West Virginia.

AUBURN, IND. — Improvements are contemplated to the municipal electric light plant, including the installation of a 480-hp. boiler and the erection of a smokestack, 135 ft. high and 6½ ft. in diameter at the top. It is also proposed to equip the plant with an automatic coal conveyor and to install underfeed stokers under three boilers, etc. The cost of the improvements is estimated at about $40,000.

CAIRO, ILL.—Arrangements are being made for the installation of a new street-lighting system, on which work will begin early in 1920. Ornamental standards will be used.

CHICAGO, ILL.—Plans have been prepared by H. M. Byllesby & Company, 208 South La Salle Street, Chicago, for the installation of 33,500 hp. in three new power houses. One of these stations will be located in southern Minnesota, which is served by the Northern States Power Company. The equipment will include a 13,500-hp. steam turbine, three 1165-hp. boilers with coal and ash-handling machinery, etc. Provision will be made for a second unit of 20,000 hp. to be installed later. A new station with an initial installation of 10,000 hp. will be erected in western Oklahoma to meet the growing demands upon the Muskogee, Sapulpa and Drumright divisions of the Oklahoma Gas & Electric Company. The third station, to have a capacity of 10,000 hp., will be erected at Pueblo, Col., adjacent to the present power house of the Arkansas Valley Railway, Light & Power Company.

MADISON, WIS.—The Madison Gas & Electric Company is contemplating the purchase of several hundred Westinghouse meters, six Westinghouse Luxolite arc lamps and overhead material for ordinary short extensions. George E. Wagner is superintendent.

MAZOMANIE, WIS.—Improvements are contemplated by the Municipal Light & Water Company, including the installation of 35 kva. in transformers, sizes from 3 to 5 kva. Overhead line materials will be

required, including 100 white cedar poles and 4 miles of No. 6 bare copper wire and 15 General Electric meters. R. D. Denu is engineer in charge.

MERRILLAN, WIS. — The village officials are considering changing the waterwheel and installing a new 75-kw. generator (umbrella type) in the municipal electric light plant. As yet no definite steps have been taken, and should a change be decided upon nothing will be done before May, 1920.

POYNETTE, WIS.—The Badger Electric Service Company, successor to the Inter-County Power & Light Company, is contemplating improvements to its system, including the installation of one 25-kw., 13,200/2300-volt transformer, also all sizes of transformers, 2300/110/220-volts, and three 15-kw., 13,200/2300-volt transformers, at Poynette; also the erection of transmission line for which 400 cedar poles, 30 ft. by 6 in., scant, 30 miles of No. 6 or No. 8 bare copper wire, 20,000 volts, insulated, will be required. L. M. Libby is in charge of the work. The main office of the company is in Madison.

STURGEON BAY, WIS. — The High Falls Power Company is contemplating the erection of a transmission line from High Falls to Sturgeon Bay. If this line is not built, the city will enlarge the municipal plant or build a new one.

TOMAH, WIS.—The Tomah Light & Power Company is planning to build a new steam-driven generating plant of 400-kw. capacity and would like to communicate with dealers and manufacturers of equipment for electric plants. For further information address L. W. Barnes, Tomah Light & Power Company, Tomah.

WEYERHAUSER, WIS. — Theodore Kurth, Jr., owner of the local electric light plant, is contemplating the installation of a 15-kw., 125-volt direct-current compound-wound generator; also the purchase of 5-amp., two-wire, 110-volt direct-current meters and incandescent lamps, all sizes up to 250-watt, 110-volt.

GLYNDON, MINN. — The village of Glyndon has decided to install an electric lighting system and erect a transmission line to Dilworth to secure electricity from the system of the Union Light, Heat & Power Company of Fargo, N. D.

TRAER, IOWA.—The city of Traer will purchase a 400-hp. boiler for the municipal electric light plant in March. The erection of about 40 miles of transmission lines to the farming section is contemplated. E. Noyer is manager.

IPSWICH, S. D.—The installation of a 100-hp. oil-engine or gas-engine unit and rebuilding its distributing system is under consideration by the Ipswich Electric Light & Power Company. M. P. Beebe is secretary.

WAKONDA, S. D.—The city of Wakonda is considering the purchase of the local electric light plant. If taken over by the municipality, it will be enlarged.

KILLEEN, NEB.—The electric plant of the City Light & Power Company was destroyed by fire on Nov. 1. The plant will be rebuilt, but as yet the equipment has not been decided upon. The old plant was equipped with a 220-volt direct-current generator driven by a Bessemer oil engine. N. Whitenburg is chief engineer.

WYNOT, NEB.—The installation of a 75-hp. engine in the municipal electric light plant is under consideration.

ELK CITY, KAN.—The C. R. Long Light & Power Company is contemplating the installation of a new electric generating unit, consisting of a 100-hp. oil engine and 75-kva. generator, and the erection of 8 miles of transmission line. J. R. Logan is superintendent.

PHILLIPSBURG, KAN.—Improvements are contemplated by the Phillips County Light & Power Company, including the installation of a 200-hp. boiler and a 250-hp. steam engine-driven generating unit and the erection of 10 miles of 13,200-volt transmission line to Almena. A. E. Bent of Denver, Col., is manager.

Southern States

EHRHARDT, S. C.—Plans have been prepared by the Ryan Engineering Company of Sumter for the installation of a new municipal electric light plant.

CLEVELAND, OKLA.—The Oklahoma Utility Company is erecting an electric transmission line to Osage, Okla., and is contemplating the installation of a new gas-engine-driven electric generating unit. H. C. Warfield is manager.

ABILENE, TEX.—Plans are being prepared for the erection of a new central station in Abilene for the Abilene Gas & Electric Company. A. Hardgrave of Dallas is vice-president.

AMARILLO, TEX.—Extensions and improvements are contemplated by the City Water & Light Company to its electric generating plant at First and Tyler Streets, including the installation of two 500-hp. Babcock & Wilcox boilers, one 1250-kw. Westinghouse generator and turbine, 325 kva. in transformers (various sizes). Materials for about 8 miles of overhead line and 150 meters in various sizes will be required. J. R. McCormick is superintendent of construction.

GORDON, TEX. — The Gordon-Mingus Light Company contemplates increasing its capital stock to $15,000 and to install additional machinery, including a 50-hp. oil engine and a 35-kva. generator (directly connected), and complete switchboard equipment. The company will also erect about 5 miles of overhead line, using No. 10 weatherproof wire. W. S. Dawson is president and manager.

HEARNE, TEX.—Improvements are being made to the city water and light plant, including the installation of a 125-hp. Skinner Unaflow engine, one Westinghouse 75-kva., three-phase, 60-cycle, 2000-volt alternator; one General Electric switchboard panel, one voltmeter, three ammeters, etc. H. D. Beaumont is superintendent.

HOUSTON, TEX.—Contracts have been awarded by the Houston Lighting & Power Company for extensions to its power house on Gable Street and the Galveston, Houston & Henderson Railroad and the installation of new equipment, including one 600-hp. and one 768-hp. Babcock & Wilcox boiler, Peabody furnaces and Leahy oil burners, one 8000-kw. Westinghouse steam turbine, one 10,000-kva., 60-cycle, 2300-volt Westinghouse generator and General Electric switchboard equipment, etc. H. S. Badger, resident engineer, 1201 Capitol Avenue, has charge of the work.

HUBBARD CITY, TEX.—Plans are being considered by the Central Light & Power Company for the installation of a 150-hp. boiler with coal-conveying equipment, for which contract will soon be let. W. A. Bass is president and manager.

LA PORTE, TEX.—The La Porte Water, Light & Ice Company is planning to install a new ice plant, cold-storage system and a new electric generating unit. New equipment, including a 145-kva., 60-cycle, 2300-volt generator, a 100-hp. steam engine and boiler will be purchased. The company would like prices on 100 30-ft. Western red-cedar poles, 1500 ft. No. 8 weatherproof wire, 100 5-amp., 110-volt meters, etc. Phil. J. Pfeiffer is owner and manager.

LONGVIEW, TEX.—Plans are being prepared for the construction of a new ice plant for the Longview Ice & Light Company. A. Hardgrave of Dallas is vice-president.

SAN BENITO, TEX. — The Commonwealth Water & Electric Company is considering the installation of a 200-hp. generating unit complete. A. L. Harris is manager.

WARTON, TEX.—The Texas Gas & Electric Company is installing additional equipment at its local plant, including one 75-kva. Westinghouse alternator belted to a 125-hp. Erie steam engine; one 180-kw. General Electric alternator belted to a 250-hp. Ames Unaflow steam engine, with General Electric switchboard and instruments; one 20-ton York-Vaile steam condenser, and a complete overhauling of the compression ice-making system and steam boilers. The company is also extending its light and power lines. H. E. Johnson is division manager; C. B. Savage is chief engineer.

Pacific and Mountain States

BELLINGHAM, WASH. — The Puget Sound Traction, Light & Power Company is contemplating extending its transmission lines into the farming district and will require overhead material for 5 miles of 6600-volt line and 400 Westinghouse meters. R. U. Muffley is engineer in charge.

ENUMCLAW, WASH. — Work has started on the power station of the White River Lumber Company near Enumclaw. The building will be 40 ft. by 50 ft., two stories. The equipment will include a 2000-kw. steam-driven generator. The cost of the station is estimated at $15,000 and the equipment at $40,000. E. J. Barry, electrical engineer, has charge of the work.

PORT WASHINGTON, WASH.—Extensions are being made to the municipal electric light plant, including an addition to power station and the installation of a Nordberg engine and a General Electric 500-kva., three-phase, 60-cycle generator, and revamping and enlarging the present switchboard. Cahill & Douglass of Milwaukee are engineers in charge. M. J. Melville is general manager.

SEATTLE, WASH.—The Mayor has authorized the superintendent of pubic utilities to prepare tentative plans for a large terminal building for elevated street car lines and subway system, to cost about $6,000,000.

SEATTLE, WASH.—The Board of Public Works will call for bids for one 78-in. steel penstock from 1500 to 2000 ft. long, to be used in connection with the new pipe line, which will run from the new dam to the municipal power house. The cost is estimated at $120,000. Date of opening the bids has not been decided upon.

TWIN FALLS, IDAHO.—The Farmers' Mutual Power Company of Twin Falls has purchased the Clear Lake power site, on which it will erect a plant to develop 3500 hp. Work will begin at once on relocating the power lines.

YUMA, ARIZ. — Arrangements, it is understood, are being made by the New King Mining Company, which operates in the Kola mining field, for the erection of a high-tension transmission line from Yuma to its properties, a distance of about 70 miles. W. J. Johnson is manager.

HARDIN, MONT. — The Big Horn Canyon Irrigation Company is planning to build a reservoir 60 miles long. Approximately 40,000 acres will be irrigated. The pumps will be operated by electricity generated at the dam.

BASIN, WYO.—The question of changing the steam equipment in the municipal plant to gas or oil is under consideration. As yet no definite action has been taken.

COWLEY, WYO.—The Cowley Electric Company is contemplating the purchase of a number of transformers. The company will buy electricity from the Wyoming Dehydrating Company, which is building a 250-hp. plant and erecting a transmission line from Cowley Station to Cowley, a distance of 1½ miles. C. S. Vaterlaus is owner and manager of the Cowley company.

LUSK, WYO.—Arrangements are being made by the Light, Power and Water Department for extensions to the municipal plant, including the installation of three 200-hp. (each) Casey-Hedges boilers, two Westinghouse turbo-generators, one 300 kw. and the other 500 kw., and a seven-panel, four-circuit Westinghouse switchboard complete. All equipment has been purchased. Royal D. Salisbury of Denver, Col., is engineer in charge of the work. L. S. Berry is superintendent.

Record of Electrical Patents

Notes on United States Patents

(Issued November 11, 1919)

1,321,197. MECHANISM FOR THE TRANSMISSION AND RECEPTION OF SOUND; Harold J. W. Fay, Westboro, Mass. App. filed March 16, 1915. Transmission through water.

1,321,203. PLANER; George E. Greenleaf and Harold L. Blood, Plainfield, N. J. App. filed Oct. 19, 1916. Automatic power-feeding device for different conditions of planing.

1,321,221. ELECTRIC HEATING APPARATUS; Albert D. Macpherson, Chicago, Ill. App. filed May 27, 1918. For hot plate or iron.

1,321,244. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed March 9, 1918. Knife type with interlock between switch and cover.

1,321,287. AUTOMATIC THERMOSTAT; Thomas J. M. Daly and Lamar Dalton, Little Rock, Ark. App. filed April 30, 1919. Three-element thermostat actuated by change in temperature of resistance coil.

1,321,309. ELECTRIC ARC PERFORATING, CUTTING OR REDUCING ELECTRODE; Claude J. Holslag, South Orange, N. J. App. filed March 3, 1919. Electrode impregnated with oxygen-liberating compound.

1,321,313. NON-GROUNDED OR METALLIC CIRCUIT SYSTEM; Alexander E. Keith, Hinsdale, Ill. App. filed April 18, 1907. Transmits impulses over two sides of a line circuit in series.

1,321,333. SWITCH HANDLE; Roscoe Ratcliffe, New Britain, Conn. App. filed May 26, 1919. Spring-type release.

1,321,342. REGULATION OF THE VOLTAGE OR CURRENT IN ALTERNATING ELECTRIC DISTRIBUTING SYSTEMS; Gerardus Jacobus van Swaay, Delft, Netherlands. App. filed Jan. 23, 1915. Apparatus connected in or across the load-carrying conductors have no contacts moving during the operation.

1,321,347. METHOD OF AND MEANS FOR INDICATING THE CONDITION OF STEEL, IRON OR OTHER MAGNETIZABLE METAL DURING HEAT TREATMENT; Lancelot W. Wild and Eric P. Barfield, Westminster, London, Eng. App. filed May 22, 1918. Current induced in coil by change in magnetic flux due to demagnetization of steel at critical temperature.

1,321,390. COMBINED SWITCH AND FUSE; Achille J. Pelletier and Fernand Belisle, Ottawa, Ont., Can. App. filed March 22, 1918. Detachable connecting element with inclosed renewable fuses.

1,321,432. METHOD OF AND APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. Operated by means of reactions in the mercury-vapor path.

1,321,433. GAS OR VAPOR LAMP AND METHOD OF OPERATING THE SAME; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. Subjects space between electrodes to action of magnetic field.

1,321,434. APPARATUS FOR REGULATING ELECTRIC CIRCUITS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. Mercury-vapor regulator.

1,321,435. METHOD OF AND MEANS FOR CREATING IN A PORTION OF AN ELECTRIC CIRCUIT A FALLING ELECTROMOTIVE-FORCE CHARACTERISTIC; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. Creates a predetermined falling electromotive-force characteristic.

1,321,436. METHOD OF AND MEANS FOR VARYING THE FREQUENCY OF AN OSCILLATING CURRENT; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. For wireless telegraphy, telephony, and motor control.

1,321,437. MEANS FOR PRODUCING PERIODIC OR ALTERNATING CURRENTS AND CONTROLLING THE FREQUENCY OF THE SAME; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed May 12, 1914. Subjects space between electrodes to influence of a body possessing capacity to change frequency of current.

1,321,438. METHOD OF AND APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed July 1, 1905. Elimination of negative electrode factor of interruption.

1,321,483. CONTROL APPARATUS; Karl A. Simmon, Wilkinsburg, Pa. App. filed April 4, 1914. Polyphase liquid rheostat with several sets of electrodes connected in star relation.

1,321,484. CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, Pa. App. filed July 3, 1916. Field-control systems for vehicles.

1,321,486. PANELBOARD; Henry F. Starrett, Chicago, Ill. App. filed Oct. 27, 1916. Standard unit type with special bus attachment.

1,321,487. PANELBOARD CONSTRUCTION; Henry F. Starrett, Chicago, Ill. App. filed June 13, 1911. Special switch mounting.

1,321,488. PANELBOARD; Henry F. Starrett, Chicago, Ill. App. filed June 13, 1911. Concealed busbar construction.

1,321,489. PANELBOARD; Henry F. Starrett, Chicago, Ill. App. filed May 17, 1912. Receptacles, binding posts, etc., accessible from front of board.

1,321,505. RECTIFIER SYSTEM; Quincy A. Brackett, Pittsburgh, Pa. App. filed April 23, 1915. Voltages adjusted for charging storage batteries.

1,321,509. CONTROL APPARATUS; Ora A. Colby, Larimer, Pa. App. filed Sept. 25, 1914. Polyphase liquid rheostat having a regulating discharge valve.

1,321,522. CONTROL APPARATUS; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 1, 1916. Steam generated in rheostat has free outlet to atmosphere.

1,321,523. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 3, 1916. Suitable control and supply apparatus to produce uniform acceleration.

1,321,524. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 3, 1917. Torque-relay device for coasting.

1,321,533. MOTOR DEVICE; Fritz P. Mansbendel, Brooklyn, N. Y. App. filed July 9, 1917. Keeps frequency of vibration within limits.

1,321,543. LINE TESTER; William H. Niswonger, Bad Axe, Mich. App. filed Aug. 25, 1916. Finds short circuits or grounds.

1,321,590. ALTERNATING-CURRENT MOTOR; Eric A. Binney, Washington, D. C. App. filed March 19, 1918. Improves speed-torque characteristic.

1,321,645. CIRCUIT CONTROLLER; Charles J. Klein, Milwaukee, Wis. App. filed Jan. 4, 1915. Insures continuance of pre-established circuit conditions.

1,321,649. ELECTRIC HEATING APPLIANCE; Edwin N. Lightfoot, New York, N. Y. App. filed March 19, 1917. Externally heated type.

1,321,682. ZIGZAG CARBON ELECTRIC RESISTOR; John Thomson, New York, N. Y. App. filed Oct. 7, 1918. Maximum resistance for carbon body of given dimensions.

1,321,685. ELECTRIC FURNACE FOR REDUCING OXIDIZED ZINC CONCENTRATES BY CARBON; John Thomson, New York, N. Y. App. filed Jan. 27, 1919. Zigzag resistor immune to oxidation and non-reactive with carbon.

1,321,696. HAIR-WAVING APPARATUS; Arthur J. Zirger, New York, N. Y. App. filed Feb. 19, 1919. Different temperatures by concentric layers of mica, heating units and moisture-carrying envelope.

1,321,793. GALVANOPLASTIC PROCESS AND PRODUCT; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. For manifolds of aeroplane engines.

(Issued November 18, 1919)

14,760. WIRELESS TELEGRAPHY; Leonard F. Fuller, Palo Alto, Cal. App. filed April 11, 1916. Higher antenna current with given input than heretofore.

1,321,864. ELECTRIC LIGHTING APPARATUS; Charles Wirt, Philadelphia, Pa. App. filed July 23, 1915. Pull socket.

1,321,873. VARIABLE-RESISTANCE UNIT; Alfred A. Ziegler, Boston, Mass. App. filed September 22, 1914. Sliding contact varies resistance.

1,321,936. ELECTROLYTIC GALVANIZING MACHINE; Constantine G. Miller, Chicago, Ill. App. filed January 19, 1917. For cylindrical objects.

1,321,947. ELECTRIC BATTERY; Elmer A. Sperry, Brooklyn, N. Y. App. filed April 2, 1915. Production of large currents over a brief period.

1,321,960. ELECTRIC LAMP-LIGHTING DEVICE; Grant Wheat, Corry, Pa. App. filed June 3, 1916. Battery lamp for miners.

1,322,187. ARRANGEMENT IN RECTIFIERS FOR ELECTRIC ALTERNATING CURRENTS; Julius Hartman, Copenhagen, Denmark. App. filed March 7, 1919. Regulation of rectified current.

1,322,216. CHIME CLOCK; Thomas C. Adams and Arthur M. Boach, Minneapolis, Minn. App. filed May 15, 1916. Commutator device closes different chime circuits.

1,322,315. METHOD OF AND APPARATUS FOR GENERATING ELECTRICAL OSCILLATIONS; Fritz Lowenstein, New York, N. Y. App. filed November 29, 1918. Stabilizes arc.

1,322,353. PRIMARY BATTERY; Charles B. Schoenmehl, Waterbury, Conn. App. filed May 22, 1917. Exposed working surface of negative electrode increased as positive electrode is eaten away.

1,322,416. ELECTRIC FURNACE FOR HEATING, ANNEALING AND MELTING METALLIC MATERIAL; Mario Fossati, Turin, Italy. App. filed March 6, 1919. Induction and resistance electric furnace.

1,322,417. OXYGEN CELL; Joseph H. Fischer, Chicago, Ill. App. filed April 1, 1919. Large area of active surface.

1,322,431. CIRCUIT CONTROLLER; Edward A. Halbleib and Frank H. Banner, Rochester, N. Y. App. filed August 20, 1918. Closed by reciprocating contact member.

1,322,479. WELDING MACHINE; Alvin E. Buchenberg, Toledo, Ohio. App. filed April 22, 1919. For chime-welding operation.

1,322,480. CONTROLLER; Ulysses E. Cowgill, Alton, Ill. App. filed February 14, 1918. Oil-filled type for crane service.

1,322,491. ELECTRODE; Jesse C. King, Montreal, Que., Can. App. filed March 21, 1917. Protected by silica and graphite coating.

(Issued November 25, 1919)

1,322,759. REGISTERING AND CONTROLLING EQUIPMENT; Warren W. Carpenter, Newark, N. J. App. filed December 30, 1916. Reduces time necessary for setting of registers.

1,322,774. ELECTRICAL APPARATUS FOR CONTROLLING CURTAINS AND LIGHTS IN THEATERS; Charles E. Falconbridge and James W. Lewsley, Nottingham, Eng. App. filed June 2, 1919. Electromagnetically operated drum attachments operate curtains.

1,322,844. REGENERATIVE BRAKING SYSTEM; Walter V. Turner, Wilkinsburg, Pa. App. filed February 5, 1916. Voltage maintained within predetermined limits.

1,322,845. REGENERATIVE BRAKING SYSTEM FOR SERIES MOTORS; Walter V. Turner, Wilkinsburg, Pa. App. filed September 6, 1916. Separate supply current unnecessary to energize fields for regenerative braking.

1,322,989. INCANDESCENT ELECTRIC-LAMP SOCKET; Robeson B. Wolcott, Cleveland, Ohio. App. filed May 13, 1916. Socket divided in two parts longitudinally.

1,322,996. DRUM CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed August 21, 1916. Increasedd number of steps for given angular drum movement.